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A GUIDE TO USE OF THE XWAVE PROGRAM. PART II. SCATTERING OF SOU--ETC(U)
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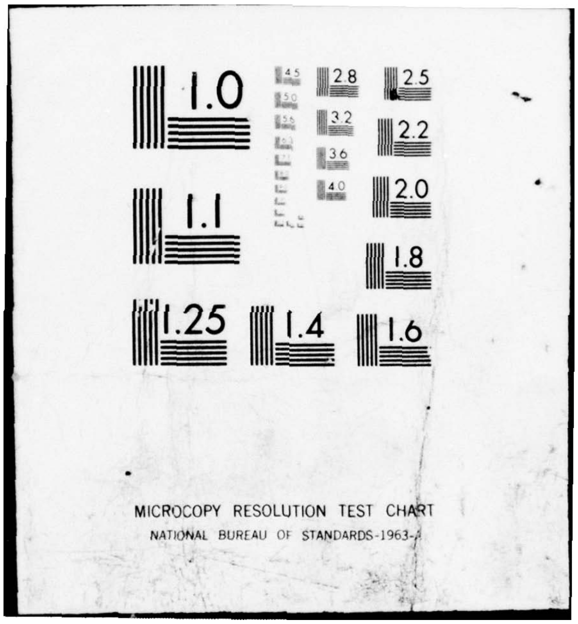
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DAVID W. TAYLOR NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER

Bethesda, Md. 20084

A GUIDE TO USE OF THE XWAVE PROGRAM: PART II – SCATTERING OF SOUND WAVES FROM RIGID STRUCTURAL SURFACES

by

Francis M. Henderson

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This report reviews a generalized formulation of the steady-state boundary value problem for scattering of infinite plane waves by an arbitrary closed rigid surface immersed in an infinite fluid. The normal velocity distribution generated over the closed surface by scattering of plane waves can also be interpreted as the boundary condition of an equivalent → next page

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steady-state radiation problem. The numerical solution of rigid surface scattering problems is therefore obtainable by a simple extension of capabilities of the XWAVE program. The additional data required by XWAVE for rigid-surface scattering applications and several sample calculations are presented.

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ABSTRACT

This report reviews a generalized formulation of the steady-state boundary-value problem for scattering of infinite plane waves by an arbitrary closed rigid surface immersed in an infinite fluid. The normal velocity distribution generated over the closed surface by scattering of plane waves can also be interpreted as the boundary condition of an equivalent steady-state radiation problem. The numerical solution of rigid surface scattering problems is therefore obtainable by a simple extension of capabilities of the XWAVE program. The additional data required by XWAVE for rigid-surface scattering applications and several sample calculations are presented.

FORMULATION OF BOUNDARY-VALUE PROBLEM FOR RIGID-BODY SCATTERING

Part I[1] of this documentation described a numerical method for obtaining the radiated pressure field external to the surface of a structure vibrating in an ideal, infinite fluid. This problem is mathematically posed by the wave equation with attendant boundary conditions at infinity and on the structural surface.[1] It is well known[2,3] that boundary-value problems such as the one describing sound pressure from submerged vibrating surfaces can also be interpreted as formulating the

---

[1] Henderson, F.M., "A Guide to Use of the XWAVE Program: Part I - Radiated Pressures From Vibrating Structures," DTNSRDC Report 77-0041 (Jun 1977).

[2] Chertock, G., "Integral Equation Methods in Sound Radiation and Scattering from Arbitrary Surfaces," NSRDC Report 3538 (Jun 1971).

[3] Junger, M.C., and D. Feit, "Sound, Structures and Their Interaction," MIT Press, Cambridge, Massachusetts, and London, England (1972).

sound field produced when trains of pressure waves impinge on and are scattered by structural surfaces.

To obtain this alternative formulation, the vibrating structure considered in the earlier report[1] is replaced by a rigid-body surface (see Figure 1) on which a time-independent succession of infinite plane waves impinges.

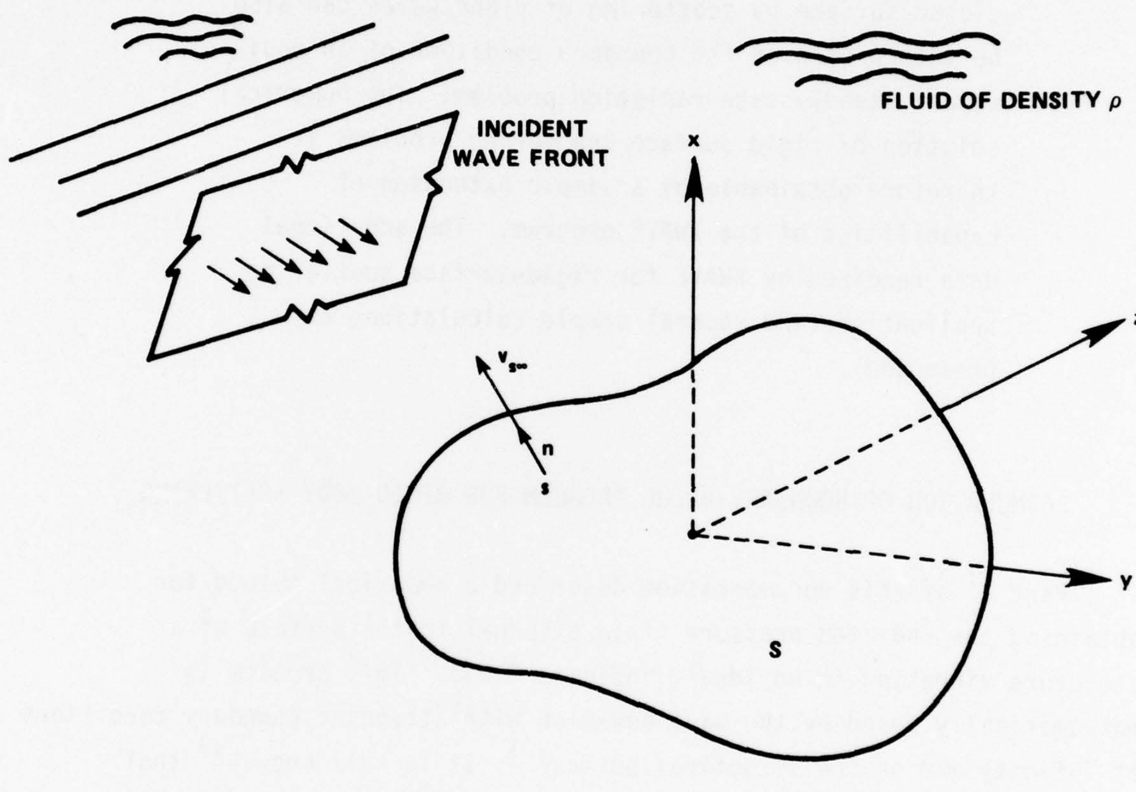

Figure 1 - Rigid-Body Scatterer Immersed in an Infinite Fluid

It is of practical interest to consider plane wave incidence since in applications such as active sonar detection problems the wave source is sufficiently far from the scattering obstacle that the radius of curvature of the wave fronts near the obstacle can be considered essentially infinite. In addition, the decrease in pressure from geometric spreading

of the incident wave over the scattering surface can be neglected.[3]

The total pressure (above ambient) in the field is the sum of the incident and scattered wave pressures,

$$p(\underline{z}) = p_i(\underline{z}) + p_{s\infty}(\underline{z}) \tag{1}$$

where $\underline{z}$ denotes field points and $p_{s\infty}$, in the notation of Junger and Feit,[3] denotes field pressures scattered from rigid (infinite impedance) boundaries. Since the total pressure p must satisfy the wave equation, the scattered pressure must also satisfy it,

$$\nabla^2 p_{s\infty}(\underline{z}) + k^2 p_{s\infty}(\underline{z}) = 0 \tag{2}$$

k is the wave number of the incident pressure wave; $k \equiv \omega/c$ in which

ω is the angular frequency of the incident pressure wave

c is the speed of sound in the fluid

The presence of the rigid boundary requires the sum of the fluid particle velocities in the incident and scattered waves at any point on the body surface to be zero,

$$\frac{\partial p_i(s)}{\partial n} = - i\omega\rho v_i(s) = i\omega\rho v_{s\infty}(s) = - \frac{\partial p_{s\infty}(s)}{\partial n} \tag{3}$$

where, referring to Figure 1,

s is a point on the closed surface S of arbitrary shape

n is the direction normal to the structural surface at s

$v_i(s)$ is the incident fluid particle velocity normal to the structural surface at s

$v_{s\infty}(s)$ is the scattered fluid particle velocity normal to the structural surface at s

$p_i(s)$ is the incident pressure on the structural surface at s

$p_{s\infty}(s)$ is the scattered pressure on the structural surface at s

ρ is the fluid density

The boundary condition at infinity is

$$p_{s\infty}(\underline{z}) \approx \frac{e^{ik|\underline{z}|}}{|\underline{z}|} \; ; \; |\underline{z}| \to \infty \tag{4}$$

where $\underline{z}$ denotes a point in the fluid.

Equations (2), (3), and (4) then give the alternative boundary-value problem to be solved for rigid body scattering. When these equations are compared with their counterparts for a vibrating body, (Equations (1), (2), (3) of DTNSRDC Report 77-0041) it is seen that the only distinction between the radiation problem and the rigid-body scattering problem is the manner in which the surface boundary condition is interpreted.

GENERAL FORMULATION FOR THE BODY SURFACE BOUNDARY CONDITION

In order to perform rigid-body scattering calculations using XWAVE, a suitable representation for the normal surface boundary condition $v_{S\infty}(s)$ arising from an incident plane wave must first be obtained. Since a general direction of incidence is to be specified, it is convenient to utilize vector wave number notation.[3] With this notation the steady-state incident pressure field is given by

$$p_i(\underline{z}) = P_i e^{i\underline{k}_i(\cdot)\underline{z}} \tag{5}$$

where $\underline{k}_i$ is defined as a vector with magnitude equal to k_i and having x-, y-, z-components corresponding to the direction of wave incidence, and $\underline{z}$ is a vector denoting a field point. Taking the partial derivative of $p_i(\underline{z})$ in the direction normal (outward) to the surface S at s ($\underline{z}$ = s) gives

$$\frac{\partial p_i(s)}{\partial n} = \frac{\partial P_i e^{i\underline{k}_i(\cdot)s}}{\partial n} = \underline{\hat{n}}\cdot\nabla P_i e^{i\underline{k}_i(\cdot)s} = i\,\underline{\hat{n}}\cdot\underline{k}_i P_i\, e^{i\underline{k}_i(\cdot)s} \tag{6}$$

where $\underline{\hat{n}}$ denotes a unit vector normal to S at s and pointing to the exterior of S. Substituting this result into Equation (3) then yields

$$i\,\underline{\hat{n}}\cdot\,\underline{k}_i P_i e^{i\underline{k}_i(\cdot)s} = i\omega\rho v_{S\infty}(s) \tag{7}$$

Since the XWAVE formulation uses the nondimensional forms of pressure and

velocity

$$\bar{p} = p/\rho c v_0$$
$$\bar{v} = v/v_0 \tag{8}$$

where v_0 is an arbitrary velocity, dividing both sides of Equation (7) by $i\rho c v_0$ gives

$$\hat{\underline{n}} \cdot \underline{k}_i \bar{P}_i \, e^{i\underline{k}_i(\cdot)s} = k_i \bar{v}_{s\infty}(s) \tag{9}$$

and finally the desired expression for the surface normal velocity resulting from time-harmonic infinite plane waves incident on S from a general direction,

$$\bar{v}_{s\infty}(s) = \frac{\hat{\underline{n}} \cdot \underline{k}_i \bar{P}_i e^{i\underline{k}_i(\cdot)s}}{k_i} \tag{10}$$

Since XWAVE is based on a numerical solution to the wave equation, a finite representation for $\bar{v}_{s\infty}(s)$ is used, as in the case of the radiation calculations, in which its values are defined only for points of a discretized model of the scattering surface S (see Figure 2 of DTNSRDC Report 77-0041).

XWAVE DATA FOR THE RIGID-BODY SCATTERING PROBLEM

Equation (10) shows that the data required to calculate $\bar{v}_{s\infty}$ are:

1. x-, y-, z-coordinates of $\hat{\underline{n}}$
2. x-, y-, z-coordinates of vector wave number $\underline{k}_i$
3. x-, y-, z-coordinates of surface point s
4. magnitude, $\bar{P}_i$, of nondimensional incident pressure
5. magnitude, k_i, of $\underline{k}_i$

Since items 1) and 3) are already included as part of XWAVE's "surface geometric data",[1] additional input facility is needed only for the remaining items. To accommodate items 2) and 4) a new data card is introduced with format as follows:

• "INCIDENT PLANE WAVE DATA" CARD

Columns	Contents	Description
1-8	$\underline{k}_{i_x}$	x-component of $\underline{k}_i$
11-18	$\underline{k}_{i_y}$	y-component of $\underline{k}_i$
21-28	$\underline{k}_{i_z}$	z-component of $\underline{k}_i$
33-40	$\overline{P}_i$	Magnitude of nondimensional incident pressure wave, $\overline{P}_i = p_i/\rho c v_0$

Item 5) is entered in the space allotted to k (for radiation applications) on the "Miscellaneous Data" Card.[1]

DATA INPUT FORM (1) (see Part I of this documentation) is revised as shown in Appendix A to include the incident plane wave data card type and to indicate its position in the XWAVE data deck.

Two of XWAVE's program options (see Part I, section entitled DATA FORMATS) are augmented as follows:

• "PROGRAM OPTIONS" CARD[1]

Columns	Contents	Description
13-16		OPT4: Selector for surface velocity distribution
		Velocity distribution is:
	0005	Generated for plane wave incidence upon the body surface. (Scattering applications only)
17-20		OPT5: Selector for radiation or scattering applications
	0000	Radiation calculations
	0001	Scattering calculations

The other options and types of data as well as data configurations to be used for scattering applications are the same as those previously described for use with radiation calculations (see DATA FORMATS[1]).

SAMPLE CALCULATIONS

CALCULATION OF FAR-FIELD SCATTERED PRESSURES FROM A RIGID CYLINDER ILLUMINATED BY A PLANE WAVE NORMAL TO THE CYLINDER AXIS

An approximating analytic result[3] is used for comparison with the numerical solution for this problem. The analytic approach extends results obtained[3] for an infinite rigid cylinder that scatters a plane wave incident from the $\phi=\pi$ direction (spherical coordinates) by restricting the scattering acceleration boundary condition of the infinite cylinder to a finite length 2L, Figure 2, and by taking the acceleration distribution equal to zero for $|z| > L$.

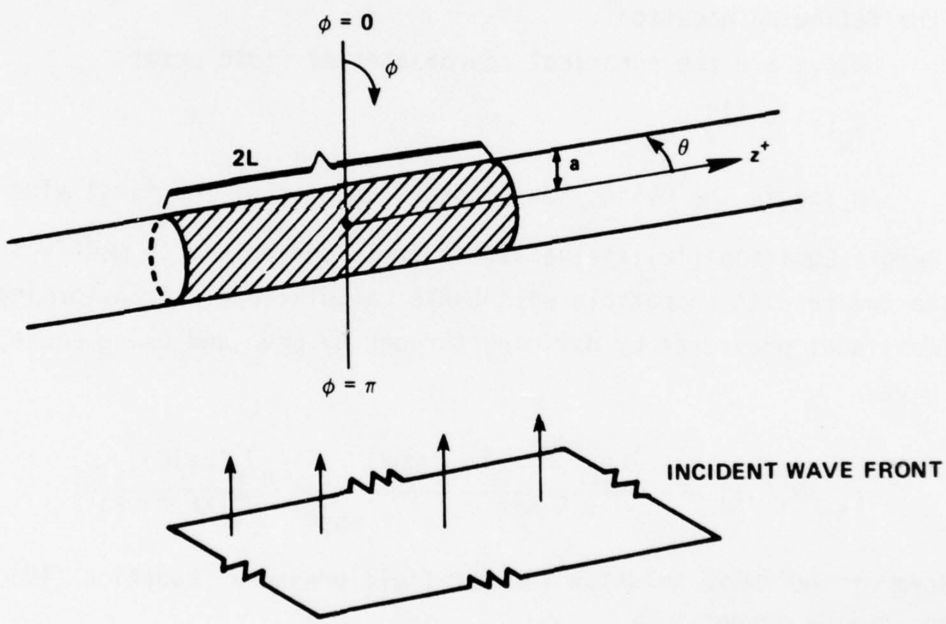

Figure 2 - Approximate Representation for Finite Cylinder Scattering of Plane Wave Incident Normal to Cylinder Axis

The acceleration for $|z|<L$ is[3]

$$\ddot{w}(z,\phi) = \frac{kP_i}{\rho} \sum_{n=0} \varepsilon_n i^n J_n'(ka) \cos n\phi \tag{11}$$

with the following notation[3]:

ε_n is the Neumann function, =1 for n=0; 2 for n>0

$J_n(x)$ is the cylindrical Bessel function of the first kind

a is the cylinder radius

The far-field scattered pressure field is expressed as[3]

$$p_{s\infty}(R,\theta,\phi) = -\frac{2Le^{ikR}P_i j_0(kL\cos\theta)}{\pi R \sin\theta} \sum_{n=0} \frac{\varepsilon_n J_n'(ka)\cos n\phi}{H_n'(ka\sin\theta)} \tag{12}$$

with the following notation[3]:

R,θ,ϕ are the spherical coordinates of field point

$j_0(x) \equiv \frac{\sin x}{x}$

$H_n(x)$ is the cylindrical Hankel function of the first kind

Before Equation (12) is evaluated, it is convenient to modify it to make the results compatible with XWAVE calculations. Transforming to nondimensional pressures by dividing through by $\rho c v_0$ and using Equation (8), gives

$$\bar{p}_{s\infty}(R,\theta,\phi) = -\frac{2Le^{ikR}\bar{P}_i j_0(kL\cos\theta)}{\pi R \sin\theta} \sum_{n=0} \frac{\varepsilon_n J_n'(ka)\cos n\phi}{H_n'(ka\sin\theta)} \tag{13}$$

The form of the XWAVE solution for far-field pressure (Equation (10) of DTNSRDC Report 77-0041) is

$$F(\underset{\sim}{z}) \equiv \frac{i}{k}\,\bar{p}(\underset{\sim}{z})\,\frac{4\pi|\underset{\sim}{z}|}{e^{ik|\underset{\sim}{z}|}} \tag{14}$$

In this expression, $\bar{p}(\underset{\sim}{z})$ denotes nondimensional pressure at $\underset{\sim}{z}$, where $\underset{\sim}{z}$ is the far-field point position vector. For the case of scattering, $\bar{p}_{s\infty}(\underset{\sim}{z})$ will correspond to $\bar{p}_{s\infty}(R,\theta,\phi)$ in Equation (13). The following

form of Equation (13) is thus compatible with XWAVE:

$$F_{s\infty}(\underset{\sim}{z}) = \frac{i}{k}\,\bar{p}_{s\infty}(\underset{\sim}{z})\,\frac{4\pi|\underset{\sim}{z}|}{e^{ik|\underset{\sim}{z}|}} = \frac{i}{k}\,\bar{p}_{s\infty}(R,\theta,\phi)\,\frac{4\pi R}{e^{ikR}}$$

$$= -\frac{8iL\bar{P}_i j_0(kL\cos\theta)}{k\sin\theta}\sum_{n=0}\frac{\varepsilon_n J_n'(ka)\cos n\phi}{H_n'(ka\sin\theta)} = F_{s\infty}(\theta,\phi) \qquad (15)$$

To illustrate the evaluation of Equation (15) the following data were used: cylinder radius a=1; cylinder half-length L=2; k=1; normalized incident pressure $\bar{P}_i=1$.

A FORTRAN program was written to perform the far-field pressure calculation. This program utilized a subroutine COMBES (PS-582A) from the Boeing Math Science Library to compute the cylindrical Bessel functions of first and second kinds, $J_n(x)$ and $Y_n(x)$, for this evaluation. These in turn were used to obtain[4]:

$$J_n'(ka) = -J_{n+1}(ka) + \frac{n}{ka}J_n(ka)$$

$$H_n(ka\sin\theta) = J_n(ka\sin\theta) + i\,Y_n(ka\sin\theta) \qquad (16)$$

$$H_n'(ka\sin\theta) = -[J_{n+1}(ka\sin\theta)+i\,Y_{n+1}(ka\sin\theta)] + \frac{n}{ka}[J_n(ka\sin\theta) + i\,Y_n(ka\sin\theta)]$$

Far-field pressures were computed around a polar great circle path (in a plane perpendicular to the incident wave) and an equatorial great circle path (in a plane parallel to the incident wave) on the surface of a large sphere ($R \to \infty$) centered about the cylinder. The results are given in Table 1.

---

[4] Hildebrand, F.B., "Advanced Calculus for Applications," (Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1962). (See in particular Chapter 4, Equations (92), (111).)

TABLE 1 - FAR-FIELD SCATTERED PRESSURES FROM FINITE, RIGID CYLINDER WITH INCIDENT PLANE WAVE NORMAL TO CYLINDER AXIS (ANALYTIC SOLUTION)

$\lvert F_{s\infty}(\theta,\phi)\rvert / \lvert F_s(\theta,\phi)\rvert^{*}_{max}$					
$\phi°$	$\theta°$	Polar Circle	$\phi°$	$\theta°$	Equatorial Circle
0	0	.3397	90	0	.3397
	5	.2932		5	.3389
	10	.2436		10	.3400
	15	.1922		15	.3451
	20	.1432		20	.3548
	25	.1102		25	.3694
	30	.1177		30	.3887
	35	.1642		35	.4126
	40	.2274		40	.4404
	45	.2956		45	.4713
	50	.3639		50	.5044
	55	.4299		55	.5383
	60	.4920		60	.5717
	65	.5484		65	.6031
	70	.5977		70	.6312
	75	.6382		75	.6545
	80	.6683		80	.6720
	85	.6870		85	.6829
	90	.6933		90	.6866
	95 : 180	Symmetry (85°-0°)		95 : 180	Symmetry (85°-0°)
180	180	.3397	270	180 : 0	Symmetry (180°-0°)
	175	.3821			
	170	.4265			
	165	.4756			
	160	.5295			
	155	.5865			
	150	.6442			
	145	.7001			
	140	.7523			
	135	.7998			
	130	.8421			
	125	.8793			
	120	.9112			
	115	.9383			
	110	.9604			
	105	.9776			
	100	.9900			
	95	.9975			
	90	1.000			
	85 : 0	Symmetry (95°-180°)			

* $\lvert F_{s\infty}(\theta,\phi)\rvert_{max} = 14.8013$

In order to obtain the numerical solution of this problem, the finite cylinder of length 2L (see Figure 2) is referenced to a Cartesian frame as shown in Figure 3,

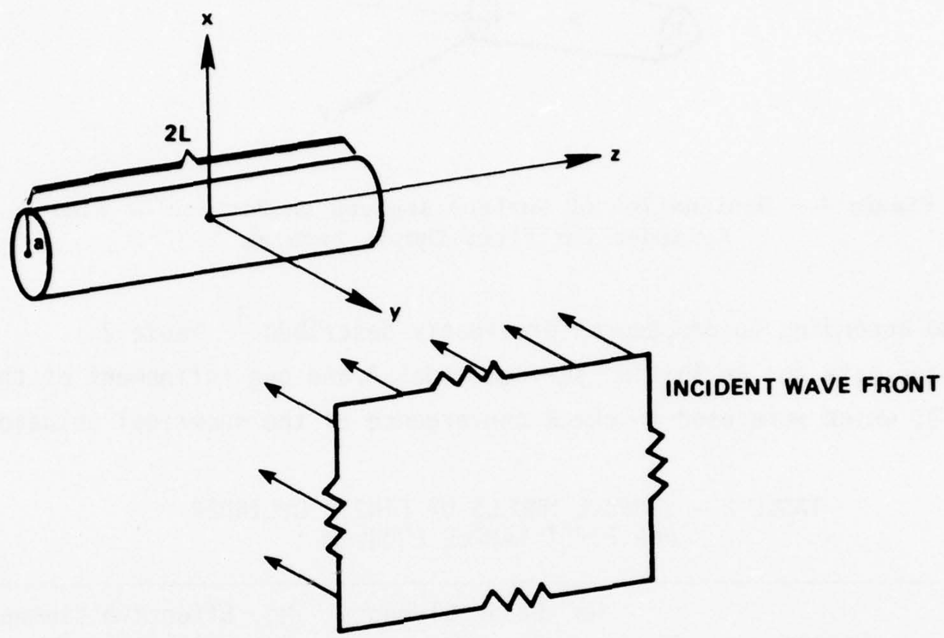

Figure 3 - Plane Wave Incidence Normal to Axis of Finite Cylinder

and the incident wave front (Figure 2) is reoriented to approach from the y^+ direction ($\phi = 90°$). The latter revision transforms the xz-plane symmetry of the surface velocity boundary condition resulting from x^- (or $\phi = \pi$) incidence to a particular pattern of yz-plane symmetry compatible with XWAVE's data input generator.

As a result of yz- and xz-plane symmetry in the cylinder geometry and velocity boundary condition, specification of the acoustic model for only one quarter of the cylinder surface is sufficient to enable the data generator to establish the total surface model. Figure 4 indicates subdivisioning of the quarter surface into "regions"[1] (numbered) for subsequent generation of surface acoustic elements.

The data which specify the surface regions and the distribution of elements over each region (and the total body surface by reflection) are

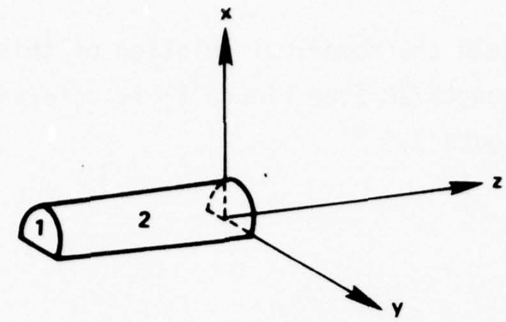

Figure 4 - Designation of Surface Regions on Portion of Finite Cylinder for First Sample Problem

prepared according to procedures previously described.[1] Table 2 summarizes data for an initial surface model, A, and one refinement of this model, B, which were used to check convergence of the numerical solution.

TABLE 2 - SURFACE MODELS OF FINITE CYLINDER FOR FIRST SAMPLE PROBLEM

	Region	n	m	No. Basic Elements Σ n x m	No. Effective Elements Over Entire Surface 4(Σ n x m)
MODEL A	1*	6	9	162	648
	2	12	9		
MODEL B	1	6	15	270	1080
	2	12	15		

* Ref. Figure 4

Numerical results for the surface modelings given in Table 2 are summarized in Table 3 and the results for the second model are compared in Table 4 and Figure 5 with results for the approximating analytic solution (Table 1). The data for XWAVE, prepared on the program's input forms, and computer output for the second calculation (Model B) are presented in Appendix B.

TABLE 3 - FAR-FIELD SCATTERED PRESSURES FROM FINITE, RIGID CYLINDER WITH PLANE WAVE NORMAL TO CYLINDER AXIS (XWAVE SOLUTION)

$\lvert F_{s\infty}(\theta,\phi)\rvert / \lvert F_{s\infty}(\theta,\phi)\rvert^{*}_{max(analytic)}$							
Equatorial Circle				Polar Circle			
$\phi°$	$\theta°$	Model 1	Model 2	$\phi°$	$\theta°$	Model 1	Model 2
270	0	.3813	.3766	0	0	.3813	.3766
	5	.3420	.3386		5	.3830	.3784
	10	.3042	.3021		10	.3883	.3837
	15	.2684	.2677		15	.3969	.3924
	20	.2363	.2369		20	.4087	.4042
	25	.2114	.2128		25	.4232	.4189
	30	.2000	.2012		30	.4402	.4361
	35	.2086	.2080		35	.4591	.4553
	40	.2390	.2355		40	.4794	.4759
	45	.2874	.2804		45	.5006	.4974
	50	.3476	.3371		50	.5219	.5191
	55	.4143	.4005		55	.5428	.5403
	60	.4826	.4659		60	.5626	.5605
	65	.5487	.5292		65	.5806	.5789
	70	.6086	.5869		70	.5963	.5949
	75	.6592	.6356		75	.6092	.6079
	80	.6975	.6726		80	.6187	.6176
	85	.7215	.6957		85	.6245	.6236
	90	.7296	.7035		90	.6265	.6256
	95 : : 180	Symmetry (85°-0°)			95 : : 180	Symmetry (85°-0°)	
90	180	.3813	.3766	180	180 : 0	Symmetry (185°-0°)	
	175	.4221	.4164				
	170	.4647	.4580				
	165	.5091	.5016				
	160	.5553	.5471				
	155	.6029	.5943				
	150	.6513	.6424				
	145	.6996	.6909				
	140	.7470	.7386				
	135	.7923	.7846				
	130	.8346	.8278				
	125	.8730	.8675				
	120	.9068	.9026				
	115	.9356	.9328				
	110	.9590	.9576				
	105	.9771	.9769				
	100	.9899	.9907				
	95	.9975	.9989				
	90	1.000	1.002				
	85 : : 0	Symmetry (95°-180°)					

* $\lvert F_{s\infty}(\theta,\phi)\rvert_{max} = 14.8013$

TABLE 4 - PERCENTAGE DIFFERENCES BETWEEN NUMERICAL AND ANALYTIC SOLUTIONS FOR FIRST SAMPLE PROBLEM

Polar Circle			Equatorial Circle		
$\phi°$	$\theta°$	% Differences*	$\phi°$	$\theta°$	% Differences*
0	0	10.9	90	0	10.9
	5	15.5		5	11.7
	10	24.0		10	12.9
	15	39.3		15	13.7
	20	65.4		20	13.9
	25	93.1		25	13.4
	30	70.9		30	12.2
	35	26.7		35	10.3
	40	35.6		40	8.06
	45	5.14		45	5.54
	50	7.36		50	2.91
	55	6.84		55	0.37
	60	5.30		60	-1.96
	65	3.50		65	-4.01
	70	1.81		70	-5.75
	75	0.41		75	-7.12
	80	0.64		80	-8.10
	85	1.27		85	-8.68
	90	1.47		90	-8.88
180	0	10.9			
	5	8.98			
	10	7.39			
	15	5.47			
	20	3.32			
	25	1.33			
	30	-0.28			
	35	-1.31			
	40	-1.82			
	45	-1.90			
	50	-1.70			
	55	-1.34			
	60	-0.94			
	65	-0.59			
	70	-0.29			
	75	-0.072			
	80	-0.071			
	85	0.14			
	90	0.20			

$$* = \frac{\text{Numerical Result-Analytic Result}}{\text{Analytic Result}} \times 100$$

Figure 5 - Far-Field Scattered Pressures from Finite, Rigid Cylinder with Incident Plane Wave Normal to Cylinder Axis. Comparison of Analytic and Numerical Solutions

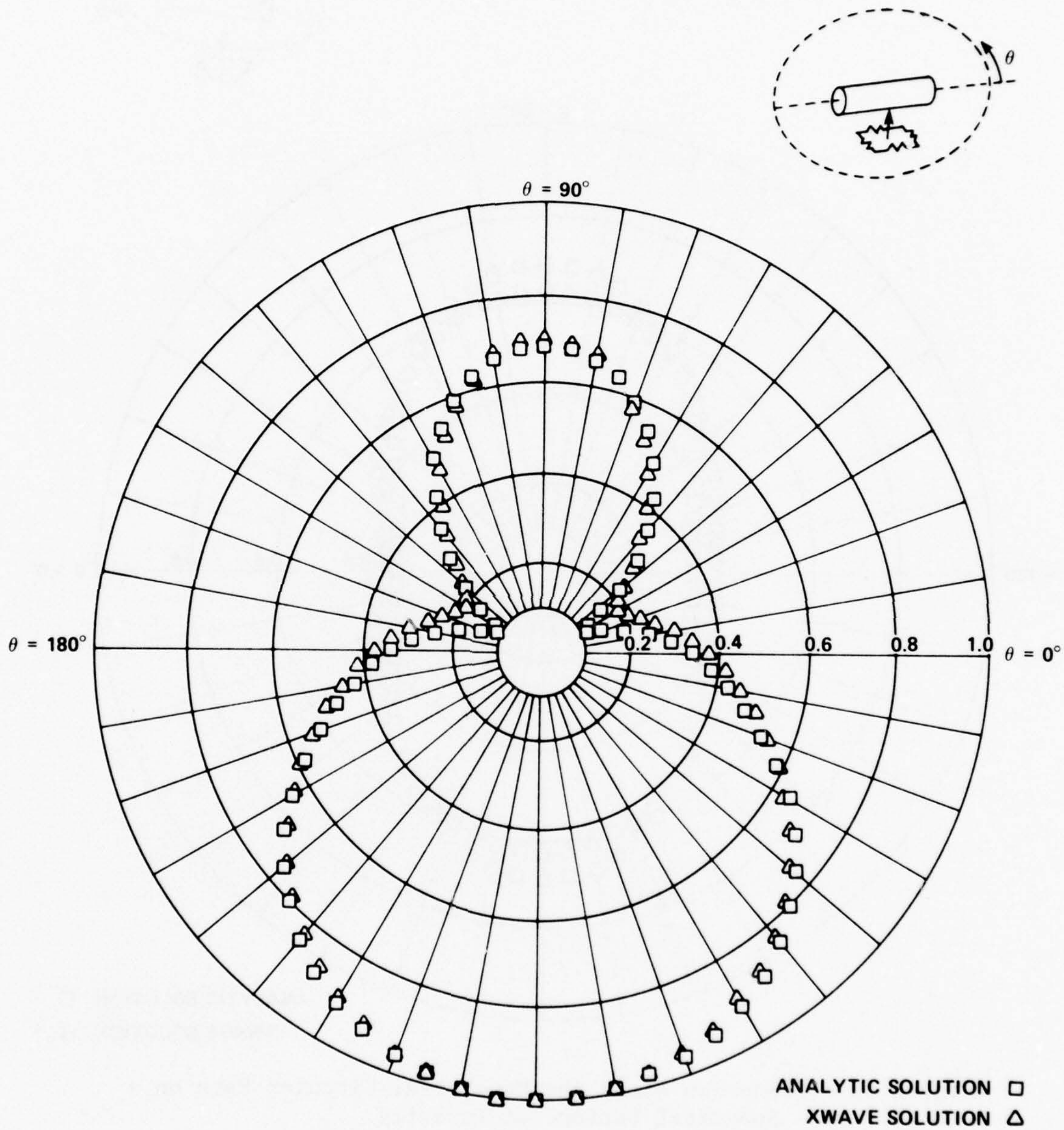

Figure 5a - Pressures Along the Polar Circular Path on a Spherical Surface at Infinity

Figure 5 (Continued)

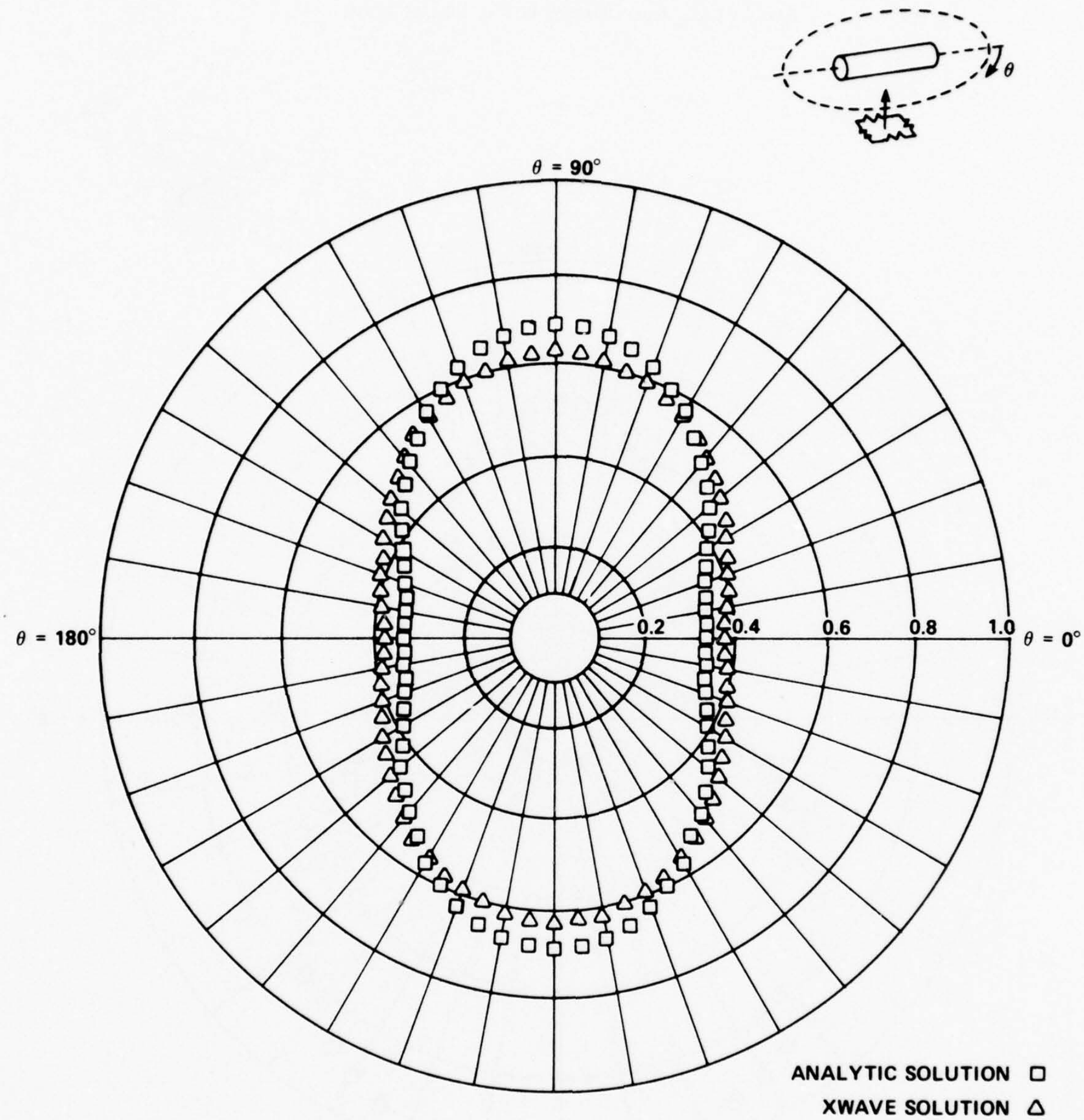

Figure 5b - Pressures Along the Equatorial Circular Path on a Spherical Surface at Infinity

CALCULATION OF FAR-FIELD SCATTERED PRESSURES FROM A RIGID CYLINDER ILLUMINATED BY A PLANE WAVE PARALLEL TO THE CYLINDER AXIS

The second sample problem illustrates the facility with which the direction of the incident wave and hence the velocity boundary condition for scattering can be varied by using the wave vector concept as implemented in XWAVE.

Instead of a plane wave incident normal to the axis of a cylinder (Figure 3), a wave propagating parallel to the z-axis from the $\bar{z}$ direction is used, as shown in Figure 6. If the wave number is assumed to be 2 for this case, the components of the wave number vector are $\underline{k}_{i_x}=0$, $\underline{k}_{i_y}=0$, $\underline{k}_{i_z}=2$. Although any direction in space could be as readily specified from the general expression for components, $\underline{k}_{i_x}=2\alpha$, $\underline{k}_{i_y}=2\beta$, $\underline{k}_{i_z}=2\gamma$, where α, β, γ are direction cosines of $\underline{k}_i$, the wave directed parallel to the z-axis generates a radially symmetric surface velocity boundary condition which in turn leads to shorter computer running times for the problem.

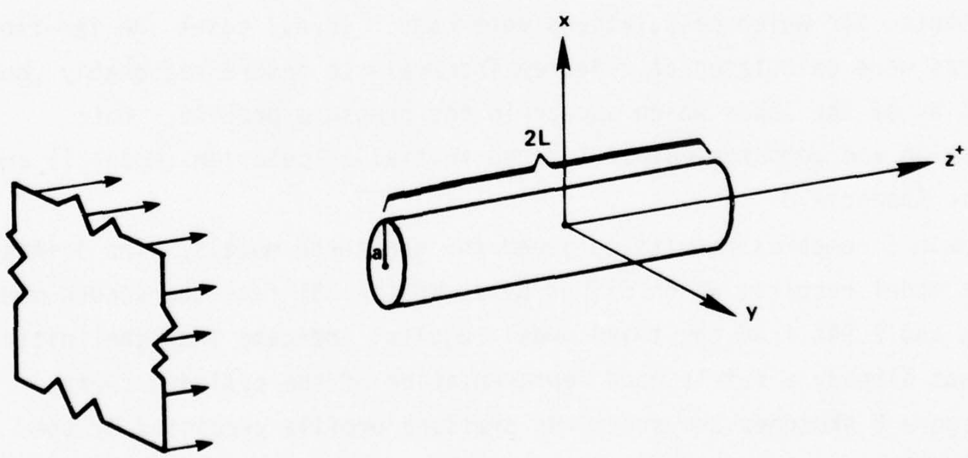

Figure 6 - Plane Wave Incidence Parallel to Axis of Finite Cylinder

The portion of the cylinder surface specified to XWAVE's data generator and the subdivision of this surface into regions used by the program in establishing surface element models are sketched in Figure 7.

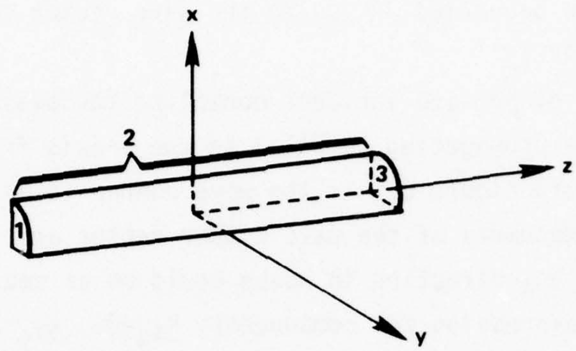

Figure 7 - Designation of Surface Regions on Portion of Finite Cylinder for Second Sample Problem

Table 5 summarizes three surface models, the initial one and two refinements, for which calculations were made. In all cases the far-field pressures were calculated at 2-degree intervals to insure reasonably good resolution of the lobes which appear in the pressure profile. Data preparation and computer output for the initial calculation (Model 1) are given in Appendix B.

Table 6 compares results obtained for the three models. The initial surface model results, which differ by at most 2.72% from the second model results and 2.94% from the third model results, indicate that the initial model was already a fairly good representation of the cylinder surface.

Figure 8 sketches the scattered pressure profile predicted by the third model.

TABLE 5 - SURFACE MODELS OF FINITE CYLINDER
FOR SECOND SAMPLE PROBLEM

	Region	n	m	No. Basic Elements Σ n x m	No. Effective Elements Over Entire Surface 4(Σ n x m)
	1*	6	9		
MODEL 1	2	12	5	168	672
	3	6	9		
	1	6	16		
MODEL 2	2	12	5	252	1008
	3	6	16		
	1	6	9		
MODEL 3	2	24	9	324	1296
	3	6	9		

* Ref. Figure 7

TABLE 6 - FAR-FIELD SCATTERED PRESSURES FROM FINITE, RIGID CYLINDER WITH INCIDENT PLANE WAVE PARALLEL TO CYLINDER AXIS. COMPARISON OF XWAVE RESULTS FOR THREE SURFACE MODELS.

$\lvert F_{S\infty}(\theta)\rvert$							
θ	Model 1	Model 2	Model 3	θ	Model 1	Model 2	Model 3
0	8.07	8.21	7.91	92	4.01	4.04	4.00
4	7.99	8.13	7.83	96	4.55	4.58	4.54
8	7.76	7.89	7.59	100	4.66	4.68	4.66
12	7.37	7.50	7.21	104	4.34	4.35	4.35
16	6.85	6.96	6.69	108	3.64	3.64	3.66
20	6.22	6.31	6.05	112	2.71	2.68	2.72
24	5.52	5.60	5.37	116	1.84	1.79	1.83
28	4.86	4.91	4.73	120	1.79	1.78	1.74
32	4.37	4.39	4.26	124	2.72	2.75	2.64
36	4.20	4.19	4.12	128	3.89	3.95	3.81
40	4.38	4.37	4.34	132	4.98	5.05	4.90
44	4.81	4.80	4.79	136	5.85	5.93	5.78
48	5.29	5.30	5.28	140	6.47	6.55	6.41
52	5.65	5.68	5.64	144	6.82	6.90	6.78
56	5.75	5.80	5.74	148	6.94	7.00	6.91
60	5.53	5.58	5.51	152	6.87	6.92	6.86
64	4.94	5.00	4.92	156	6.66	6.69	6.66
68	4.02	4.07	4.00	160	6.39	6.40	6.39
72	2.84	2.87	2.82	164	6.09	6.10	6.10
76	1.56	1.58	1.55	168	5.83	5.82	5.84
80	0.98	0.960	0.967	172	5.62	5.61	5.63
84	1.94	1.94	1.94	176	5.50	5.48	5.50
88	3.10	3.11	3.09	180	5.45	5.44	5.45

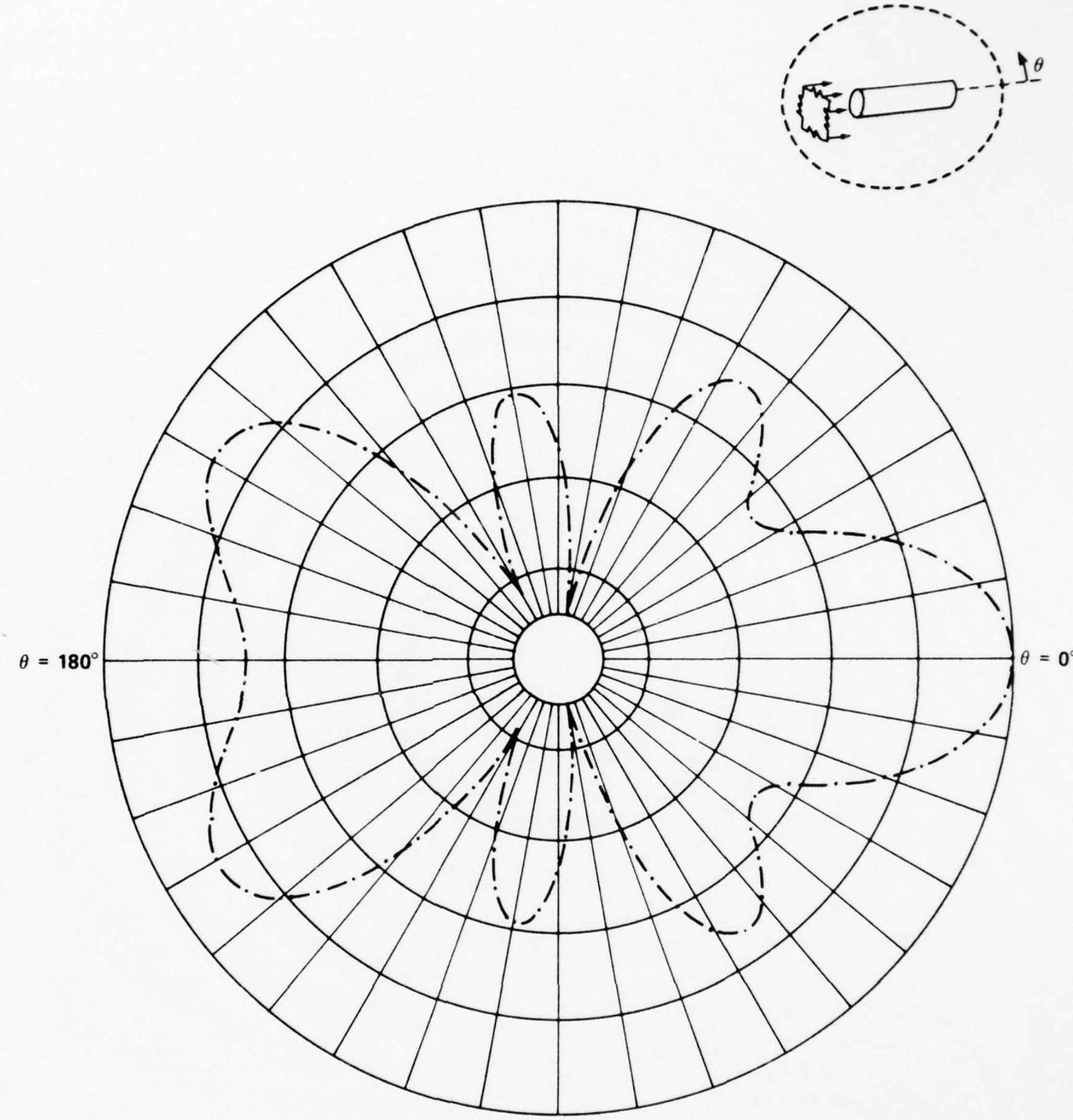

Figure 8 - Far-Field Scattered Pressures from Finite, Rigid Cylinder with Incident Wave Parallel to Cylinder Axis

APPENDIX A

AUGMENTED XWAVE DATA INPUT FORM (1)
FOR SCATTERING

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SCATTERING APPLICATIONS

TITLE ______________________________ DATE ______________

PROBLEM ______________________________ SHEET ________ OF ____

XWAVE DATA

PROBLEM TITLE ______________________________

ΔΔΔΔΔΔΔΔΔΔΔΔ

13

CASE TITLE ______________________________

ΔΔΔΔΔΔΔΔΔΔΔΔ

13

DIMENSIONS FOR XWAVE ______________________________

D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14
1	5	9	13	17	21	25	29	33	37	41	45	49	53 56

MISCELLANEOUS DATA ______________________________

$\underline{k}_i$		c	ρ	H (REAL)	H (IMAG)	ITER-ATION LIMIT	CONVERGENCE CRITERION
	ΔΔΔΔΔΔΔΔ						
1	9	17	25	33	41	49	53 60

PROGRAM OPTIONS ______________________________

OPT1	OPT2	OPT3	OPT4	OPT5	OPT6	OPT7	OPT8	OPT9	OPT10
1	5	9	13	17	21	25	29	33	37 40

INCIDENT PLANE WAVE DATA ______________________________

$\underline{k}_{i_x}$		$\underline{k}_{i_y}$		$\underline{k}_{i_z}$		$\overline{P}_i$
	ΔΔ		ΔΔ		ΔΔΔΔ	
1	8	11	18 21		28	33 40

SYMMETRY OPTIONS ______________________________

yz-PLANE	xz-PLANE	LONG.	RADIAL
1	5	9	13

DATA INPUT FORM (1)

APPENDIX B

INPUT DATA AND COMPUTER OUTPUT FOR SAMPLE CALCULATIONS

SCATTERING APPLICATIONS

TITLE SAMPLE PROBLEM 1 DATE

PROBLEM SHEET 1 OF 3

XWAVE DATA

PROBLEM TITLE

ΔΔΔΔΔΔΔΔΔΔΔΔFINITE CYLINDER - RADIUS = 1, LENGTH = 4

13

CASE TITLE

ΔΔΔΔΔΔΔΔΔΔΔΔRIGID-BODY SCATTERING OF PLANE WAVE FROM Y(+) DIRECTION

13

DIMENSIONS FOR XWAVE

D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14
0270	0010	0270	0002	0015								0019	0004
1	5	9	13	17	21	25	29	33	37	41	45	49	53 56

MISCELLANEOUS DATA

$\underline{k}_i$		c	ρ	H (REAL)	H (IMAG)	ITER-ATION LIMIT	CONVERGENCE CRITERION
1.0	ΔΔΔΔΔΔΔΔ			0.5	0.0	0030	0.0001
1	9	17	25	33	41	49	53 60

PROGRAM OPTIONS

OPT1	OPT2	OPT3	OPT4	OPT5	OPT6	OPT7	OPT8	OPT9	OPT10
0000	0001	0001	0005	0001	0001	0000	0002	0000	0001
1	5	9	13	17	21	25	29	33	37 40

INCIDENT PLANE WAVE DATA

$\underline{k}_{i_x}$		$\underline{k}_{i_y}$		$\underline{k}_{i_z}$		$\overline{P}_i$
0.0	ΔΔ	-1.0	ΔΔ	0.0	ΔΔΔΔ	1.0
1	8	11	18	21	28	33 40

SYMMETRY OPTIONS

yz-PLANE	xz-PLANE	LONG.	RADIAL
0002	0000	0001	0000
1	5	9	13

DATA INPUT FORM (1)

PIECEWISE CONICAL SHELL SURFACE

TITLE SAMPLE PROBLEM 1 DATE ______

PROBLEM ______ SHEET 2 OF 3

XWAVE DATA

NUMBER OF REGIONS

0002
1 4

REGION: EXTENT AND MODELING

r_1	r_2	θ_1	θ_2	z_1	z_2	n	m	SIGN
0.0	1.0	0.0	180.0	-2.0	-2.0	0006	0015	-1.0
1	9	17	25	33	41	49	53	57 64

NORMAL SURFACE VELOCITY

V_n (REAL)		V_n (IMAG.)
	ΔΔ	
1	8 11	18

REGION: EXTENT AND MODELING

r_1	r_2	θ_1	θ_2	z_1	z_2	n	m	SIGN
1.0	1.0	0.0	180.0	-2.0	0.0	0012	0015	
1	9	17	25	33	41	49	53	57 64

NORMAL SURFACE VELOCITY

V_n (REAL)		V_n (IMAG.)
	ΔΔ	
1	8 11	18

REGION: EXTENT AND MODELING

r_1	r_2	θ_1	θ_2	z_1	z_2	n	m	SIGN
1	9	17	25	33	41	49	53	57 64

NORMAL SURFACE VELOCITY

V_n (REAL)		V_n (IMAG.)
	ΔΔ	
1	8 11	18

DATA INPUT FORM (2)

FAR-FIELD PRESSURE CALCULATION

TITLE SAMPLE PROBLEM 1 DATE ______

PROBLEM ______ SHEET 3 OF 3

XWAVE DATA

AUTOMATIC FAR-FIELD POINT GENERATION

NFFLAT	NFFLNG		LATLIM	LONGLIM
019	004	000	90.0	270.0
1	4	7	10	18 25

ARBITRARY FAR-FIELD POINT SPECIFICATION

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

DATA INPUT FORM (15)

```
ELAPSED TIME AT ENTRY INTO XWAVE =    2.576E+01 SECONDS

THERE ARE 040711(OCTAL) WORDS OF OPEN-CORE AVAILABLE FOR THIS PROBLEM

CM REDUCED TO 075300(OCTAL)
```

XWAVE SEPTEMBER 1976

FINITE CYLINDER - RADIUS=1, LENGTH=4
RIGID-BODY SCATTERING OF PLANE WAVE FROM Y(+) DIRECTION

DIMENSIONS FOR ARRAYS

```
DIMENSION  1 = 270
DIMENSION  2 =  10
DIMENSION  3 = 270
DIMENSION  4 =   2
DIMENSION  5 =  15
DIMENSION  6 =   1
DIMENSION  7 =   1
DIMENSION  8 =   1
DIMENSION  9 =   1
DIMENSION 10 =   1
DIMENSION 11 =   1
DIMENSION 12 =   1
DIMENSION 13 =  19
DIMENSION 14 =   4
```

OPTION DATA

OP1	OP2	OP3	OP4	OP5	OP6	OP7	OP8	OP9	OP10
0	1	1	5	1	1	0	2	0	1

MAGNITUDE OF VECTOR WAVE NUMBER, K = 1.0000E+00

COMPONENTS OF VECTOR WAVE NUMBER K

X-COMPONENT	Y-COMPONENT	Z-COMPONENT
0.	-1.0000E+00	0.

MAGNITUDE OF NONDIMENSIONALIZED INCIDENT PRESSURE WAVE = 1.0000E+00

SURFACE GEOMETRY AND BOUNDARY CONDITION SYMMETRIES

YZ-PLANE SYMMETRY

LONGITUDINAL SYMMETRY

SURFACE MODEL GEOMETRY

SURFACE ELEMENT NO.	ELEMENT BASE POINT COORDINATES X	Y	Z	INVERSE CURVATURE AT BASE POINT	AREA OF ELEMENT	COORDINATES OF UNIT OUTWARD NORMAL AT BASE POINT X	Y	Z
1	8.7107E-03	8.2877E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
2	2.5751E-02	7.9255E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
3	4.1667E-02	7.2169E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
4	5.5761E-02	6.1929E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00

5	6.7418E-02	4.8982E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
6	7.6129E-02	3.3835E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
7	8.1512E-02	1.7326E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
8	8.3333E-02	-3.5004E-09	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
9	8.1512E-02	-1.7326E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
10	7.6129E-02	-3.3895E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
11	6.7418E-02	-4.8982E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
12	5.5761E-02	-6.1929E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
13	4.1667E-02	-7.2169E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
14	2.5751E-02	-7.9255E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
15	8.7107E-03	-8.2877E-02	-2.0000E+00	0.	2.9089E-03	0.	0.	-1.0000E+00
16	2.6132E-02	2.4863E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
17	7.7254E-02	2.3776E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
18	1.2500E-01	2.1651E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
19	1.6728E-01	1.8579E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
20	2.0225E-01	1.4635E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
21	2.2039E-01	1.0160E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
22	2.4454E-01	5.1978E-02	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
23	2.5000E-01	-1.0001E-08	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
24	2.4454E-01	-5.1978E-02	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
25	2.2039E-01	-1.0158E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
26	2.0225E-01	-1.4635E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00

27	1.6728E-01	-1.8579E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
28	1.2500E-01	-2.1651E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
29	7.7254E-02	-2.3776E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
30	2.6132E-02	-2.4863E-01	-2.0000E+00	0.	8.7266E-03	0.	0.	-1.0000E+00
31	4.3554E-02	4.1438E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
32	1.2876E-01	3.9627E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
33	2.0833E-01	3.6084E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
34	2.7880E-01	3.0964E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
35	3.3709E-01	2.4431E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
36	3.8064E-01	1.6947E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
37	4.0756E-01	8.6630E-02	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
38	4.1667E-01	-1.8002E-08	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
39	4.0756E-01	-8.6630E-02	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
40	3.8064E-01	-1.6947E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
41	3.3709E-01	-2.4431E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
42	2.7880E-01	-3.0964E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
43	2.0833E-01	-3.6084E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
44	1.2876E-01	-3.9627E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
45	4.3553E-02	-4.1438E-01	-2.0000E+00	0.	1.4544E-02	0.	0.	-1.0000E+00
46	6.3375E-02	5.9014E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
47	1.8026E-01	5.5478E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00

48	2.9167E-01	5.0518E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
49	3.9033E-01	4.3350E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
50	4.7193E-01	3.4287E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
51	5.3290E-01	2.3726E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
52	5.7059E-01	1.2128E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
53	5.8333E-01	-2.5203E-08	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
54	5.7059E-01	-1.2128E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
55	5.3290E-01	-2.3726E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
56	4.7193E-01	-3.4287E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
57	3.9033E-01	-4.3350E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
58	2.9167E-01	-5.0518E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
59	1.8026E-01	-5.5478E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
60	6.0975E-02	-5.8014E-01	-2.0000E+00	0.	2.0362E-02	0.	0.	-1.0000E+00
61	7.8396E-12	7.4589E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
62	2.3176E-01	7.1329E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
63	3.7500E-01	6.4952E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
64	5.0185E-01	5.5736E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
65	6.0676E-01	4.4084E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
66	6.8516E-01	3.0505E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
67	7.3361E-01	1.5593E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
68	7.5000E-01	-3.2434E-08	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
69	7.3361E-01	-1.5593E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00

70	6.8516E-01	-3.0505E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
71	6.0576E-01	-4.9084E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
72	5.0185E-01	-5.5736E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
73	3.7580E-01	-6.4952E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
74	2.3176E-01	-7.1329E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
75	7.8396E-02	-7.4589E-01	-2.0000E+00	0.	2.6180E-02	0.	0.	-1.0000E+00
76	9.5818E-02	9.1165E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
77	2.8327E-01	8.7180E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
78	4.5833E-01	7.9386E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
79	6.1337E-01	6.8122E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
80	7.4160E-01	5.3880E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
81	8.3742E-01	3.7284E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
82	8.9664E-01	1.9059E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
83	9.1667E-01	-3.3605E-08	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
84	8.9664E-01	-1.9059E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
85	8.3742E-01	-3.7284E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
86	7.4160E-01	-5.3880E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
87	6.1337E-01	-6.8122E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
88	4.5833E-01	-7.9386E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
89	2.8327E-01	-8.7180E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
90	9.5818E-02	-9.1165E-01	-2.0000E+00	0.	3.1998E-02	0.	0.	-1.0000E+00
91	1.0453E-01	9.9452E-01	-1.9157E+00	2.1000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.

92	3.0902E-01	9.5106E-01	-1.9167E+00	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
93	5.0000E-01	8.6603E-01	-1.9167E+00	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
94	6.6913E-01	7.4314E-01	-1.9167E+00	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
95	8.0902E-01	5.8779E-01	-1.9167E+00	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
96	9.1355E-01	4.0674E-01	-1.9167E+00	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
97	9.7815E-01	2.0791E-01	-1.9167E+00	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
98	1.0000E+00	-4.3205E-08	-1.9167E+00	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
99	9.7815E-01	-2.0791E-01	-1.9167E+00	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
100	9.1355E-01	-4.0674E-01	-1.9167E+00	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
101	8.0902E-01	-5.8779E-01	-1.9167E+00	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
102	6.6913E-01	-7.4314E-01	-1.9167E+00	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
103	5.0000E-01	-8.6603E-01	-1.9167E+00	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
104	3.0902E-01	-9.5106E-01	-1.9167E+00	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
105	1.0453E-01	-9.9452E-01	-1.9167E+00	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
106	1.0453E-01	9.9452E-01	-1.7500E+00	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
107	3.0902E-01	9.5106E-01	-1.7500E+00	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
108	5.0000E-01	8.6603E-01	-1.7500E+00	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
109	6.6913E-01	7.4314E-01	-1.7500E+00	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
110	8.0902E-01	5.8779E-01	-1.7500E+00	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
111	9.1355E-01	4.0674E-01	-1.7500E+00	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
112	9.7815E-01	2.0791E-01	-1.7500E+00	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
113	1.0000E+00	-4.3205E-08	-1.7500E+00	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.

114	9.7815E-01	-2.0731E-01	-1.7500E+00	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
115	9.1355E-01	-4.0674E-01	-1.7500E+00	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
116	8.0302E-01	-5.8779E-01	-1.7500E+00	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
117	6.6313E-01	-7.4314E-01	-1.7500E+00	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
118	5.0000E-01	-8.6603E-01	-1.7500E+00	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
119	3.0302E-01	-9.5106E-01	-1.7500E+00	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
120	1.0453E-01	-9.9452E-01	-1.7500E+00	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
121	1.0453E-01	9.9452E-01	-1.5833E+00	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
122	3.0302E-01	9.5106E-01	-1.5833E+00	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
123	5.0000E-01	8.6603E-01	-1.5833E+00	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
124	6.6313E-01	7.4314E-01	-1.5833E+00	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
125	8.0902E-01	5.8779E-01	-1.5833E+00	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
126	9.1355E-01	4.0674E-01	-1.5833E+00	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
127	9.7815E-01	2.0791E-01	-1.5833E+00	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
128	1.0000E+00	-4.3205E-08	-1.5833E+00	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
129	9.7815E-01	-2.0731E-01	-1.5833E+00	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
130	9.1355E-01	-4.0674E-01	-1.5833E+00	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
131	8.0902E-01	-5.8779E-01	-1.5833E+00	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
132	6.6913E-01	-7.4314E-01	-1.5833E+00	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
133	5.0000E-01	-8.6603E-01	-1.5833E+00	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
134	3.0902E-01	-9.5106E-01	-1.5833E+00	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
135	1.0453E-01	-9.9452E-01	-1.5833E+00	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.

136	1.0453E-01	9.9452E-01	-1.4167E+00	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
137	3.0902E-01	9.5106E-01	-1.4167E+00	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
138	5.0000E-01	8.6603E-01	-1.4167E+00	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
139	6.6913E-01	7.4314E-01	-1.4167E+00	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
140	8.0902E-01	5.8779E-01	-1.4167E+00	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
141	9.1355E-01	4.0674E-01	-1.4167E+00	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
142	9.7815E-01	2.0791E-01	-1.4167E+00	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
143	1.0000E+00	-4.3235E-08	-1.4167E+00	2.0000E+00	3.4907E-02	1.0000E+00	-4.3285E-08	0.
144	9.7815E-01	-2.0791E-01	-1.4167E+00	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
145	9.1355E-01	-4.0674E-01	-1.4167E+00	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
146	8.0902E-01	-5.8779E-01	-1.4167E+00	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
147	6.6913E-01	-7.4314E-01	-1.4167E+00	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
148	5.0000E-01	-8.6603E-01	-1.4167E+00	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
149	3.0902E-01	-9.5106E-01	-1.4167E+00	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
150	1.0453E-01	-9.9452E-01	-1.4167E+00	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
151	1.0453E-01	9.9452E-01	-1.2500E+00	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
152	3.0902E-01	9.5106E-01	-1.2500E+00	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
153	5.0000E-01	8.6603E-01	-1.2500E+00	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
154	6.6913E-01	7.4314E-01	-1.2500E+00	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
155	8.0902E-01	5.8779E-01	-1.2500E+00	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
156	9.1355E-01	4.0674E-01	-1.2500E+00	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
157	9.7815E-01	2.0791E-01	-1.2500E+00	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.

158	1.0000E+00	-4.3205E-08	-1.2500E+00	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
159	9.7815E-01	-2.0791E-01	-1.2500E+00	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
160	9.1355E-01	-4.0674E-01	-1.2500E+00	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
161	8.0902E-01	-5.8779E-01	-1.2500E+00	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
162	6.6913E-01	-7.4314E-01	-1.2500E+00	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
163	5.0000E-01	-8.6603E-01	-1.2500E+00	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
164	3.0902E-01	-9.5106E-01	-1.2500E+00	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
165	1.0453E-01	-9.9452E-01	-1.2500E+00	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
166	1.0453E-01	9.9452E-01	-1.0833E+00	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
167	3.0902E-01	9.5106E-01	-1.0833E+00	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
168	5.0000E-01	8.6603E-01	-1.0833E+00	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
169	6.6913E-01	7.4314E-01	-1.0833E+00	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
170	8.0902E-01	5.8779E-01	-1.0833E+00	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
171	9.1355E-01	4.0674E-01	-1.0833E+00	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
172	9.7815E-01	2.0791E-01	-1.0833E+00	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
173	1.0000E+00	-4.3205E-08	-1.0833E+00	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
174	9.7815E-01	-2.0791E-01	-1.0833E+00	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
175	9.1355E-01	-4.0674E-01	-1.0833E+00	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
176	8.0902E-01	-5.8779E-01	-1.0833E+00	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
177	6.6913E-01	-7.4314E-01	-1.0833E+00	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
178	5.0000E-01	-8.6603E-01	-1.0833E+00	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
179	3.0902E-01	-9.5106E-01	-1.0833E+00	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.

180	1.0453E-01	-9.9452E-01	-1.0833E+00	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
181	1.0453E-01	9.9452E-01	-9.1667E-01	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
182	3.0902E-01	9.5106E-01	-9.1667E-01	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
183	5.0000E-01	8.6603E-01	-9.1667E-01	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
184	6.6913E-01	7.4314E-01	-9.1667E-01	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
185	8.0902E-01	5.8779E-01	-9.1667E-01	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
186	9.1355E-01	4.0674E-01	-9.1667E-01	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
187	9.7815E-01	2.0791E-01	-9.1667E-01	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
188	1.0000E+00	-4.3205E-08	-9.1667E-01	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
189	9.7815E-01	-2.0791E-01	-9.1667E-01	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
190	9.1355E-01	-4.0674E-01	-9.1667E-01	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
191	8.0902E-01	-5.8779E-01	-9.1667E-01	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
192	6.6913E-01	-7.4314E-01	-9.1667E-01	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
193	5.0000E-01	-8.6603E-01	-9.1667E-01	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
194	3.0902E-01	-9.5106E-01	-9.1667E-01	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
195	1.0453E-01	-9.9452E-01	-9.1667E-01	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
196	1.0453E-01	9.9452E-01	-7.5000E-01	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
197	3.0902E-01	9.5106E-01	-7.5000E-01	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
198	5.0000E-01	8.6603E-01	-7.5000E-01	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
199	6.6913E-01	7.4314E-01	-7.5000E-01	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
200	8.0902E-01	5.8779E-01	-7.5000E-01	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
201	9.1355E-01	4.0674E-01	-7.5000E-01	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.

202	9.7815E-01	2.0731E-01	-7.5000E-01	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
203	1.0000E+00	-4.3205E-08	-7.5000E-01	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
204	9.7815E-01	-2.0731E-01	-7.5000E-01	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
205	9.1355E-01	-4.0674E-01	-7.5000E-01	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
206	8.0302E-01	-5.8779E-01	-7.5000E-01	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
207	6.6913E-01	-7.4314E-01	-7.5000E-01	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
208	5.0000E-01	-8.6603E-01	-7.5000E-01	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
209	3.0902E-01	-9.5106E-01	-7.5000E-01	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
210	1.0453E-01	-9.9452E-01	-7.5000E-01	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
211	1.0453E-01	9.9452E-01	-5.8333E-01	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
212	3.0302E-01	9.5106E-01	-5.8333E-01	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
213	5.0000E-01	8.6603E-01	-5.8333E-01	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
214	6.6913E-01	7.4314E-01	-5.8333E-01	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
215	8.0302E-01	5.8779E-01	-5.8333E-01	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
216	9.1355E-01	4.0674E-01	-5.8333E-01	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
217	9.7815E-01	2.0731E-01	-5.8333E-01	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
218	1.0000E+00	-4.3205E-08	-5.8333E-01	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
219	9.7815E-01	-2.0731E-01	-5.8333E-01	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
220	9.1355E-01	-4.0674E-01	-5.8333E-01	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
221	8.0302E-01	-5.8779E-01	-5.8333E-01	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
222	6.6913E-01	-7.4314E-01	-5.8333E-01	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
223	5.0000E-01	-8.6603E-01	-5.8333E-01	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.

224	3.0902E-01	-9.5106E-01	-5.8333E-01	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
225	1.0453E-01	-9.9452E-01	-5.8333E-01	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
226	1.0453E-01	9.9452E-01	-4.1667E-01	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
227	3.0902E-01	9.5106E-01	-4.1667E-01	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
228	5.0000E-01	8.6603E-01	-4.1667E-01	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
229	6.6913E-01	7.4314E-01	-4.1667E-01	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
230	8.0902E-01	5.8779E-01	-4.1667E-01	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
231	9.1355E-01	4.0674E-01	-4.1667E-01	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
232	9.7815E-01	2.0791E-01	-4.1667E-01	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
233	1.0000E+00	-4.3205E-08	-4.1667E-01	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
234	9.7815E-01	-2.0791E-01	-4.1667E-01	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
235	9.1355E-01	-4.0674E-01	-4.1667E-01	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
236	8.0902E-01	-5.8779E-01	-4.1667E-01	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
237	6.6913E-01	-7.4314E-01	-4.1667E-01	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
238	5.0000E-01	-8.6603E-01	-4.1667E-01	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
239	3.0902E-01	-9.5106E-01	-4.1667E-01	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
240	1.0453E-01	-9.9452E-01	-4.1667E-01	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
241	1.0453E-01	9.9452E-01	-2.5000E-01	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
242	3.0902E-01	9.5106E-01	-2.5000E-01	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
243	5.0000E-01	8.6603E-01	-2.5000E-01	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
244	6.6913E-01	7.4314E-01	-2.5000E-01	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
245	8.0902E-01	5.8779E-01	-2.5000E-01	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.

246	9.1355E-01	4.0674E-01	-2.5000E-01	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
247	9.7815E-01	2.0791E-01	-2.5000E-01	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
248	1.0000E+00	-4.3205E-08	-2.5000E-01	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
249	9.7815E-01	-2.0791E-01	-2.5000E-01	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
250	9.1355E-01	-4.0674E-01	-2.5000E-01	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
251	8.0902E-01	-5.8779E-01	-2.5000E-01	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
252	6.6913E-01	-7.4314E-01	-2.5000E-01	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.
253	5.0000E-01	-8.6603E-01	-2.5000E-01	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
254	3.0902E-01	-9.5106E-01	-2.5000E-01	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
255	1.0453E-01	-9.9452E-01	-2.5000E-01	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.
256	1.0453E-01	9.9452E-01	-8.3333E-02	2.0000E+00	3.4907E-02	1.0453E-01	9.9452E-01	0.
257	3.0902E-01	9.5106E-01	-8.3333E-02	2.0000E+00	3.4907E-02	3.0902E-01	9.5106E-01	0.
258	5.0000E-01	8.6603E-01	-8.3333E-02	2.0000E+00	3.4907E-02	5.0000E-01	8.6603E-01	0.
259	6.6913E-01	7.4314E-01	-8.3333E-02	2.0000E+00	3.4907E-02	6.6913E-01	7.4314E-01	0.
260	8.0902E-01	5.8779E-01	-8.3333E-02	2.0000E+00	3.4907E-02	8.0902E-01	5.8779E-01	0.
261	9.1355E-01	4.0674E-01	-8.3333E-02	2.0000E+00	3.4907E-02	9.1355E-01	4.0674E-01	0.
262	9.7815E-01	2.0791E-01	-8.3333E-02	2.0000E+00	3.4907E-02	9.7815E-01	2.0791E-01	0.
263	1.0000E+00	-4.3205E-08	-8.3333E-02	2.0000E+00	3.4907E-02	1.0000E+00	-4.3205E-08	0.
264	9.7815E-01	-2.0791E-01	-8.3333E-02	2.0000E+00	3.4907E-02	9.7815E-01	-2.0791E-01	0.
265	9.1355E-01	-4.0674E-01	-8.3333E-02	2.0000E+00	3.4907E-02	9.1355E-01	-4.0674E-01	0.
266	8.0902E-01	-5.8779E-01	-8.3333E-02	2.0000E+00	3.4907E-02	8.0902E-01	-5.8779E-01	0.
267	6.6913E-01	-7.4314E-01	-8.3333E-02	2.0000E+00	3.4907E-02	6.6913E-01	-7.4314E-01	0.

250	5.0000E-01	-8.6603E-01	-8.3333E-02	2.0000E+00	3.4907E-02	5.0000E-01	-8.6603E-01	0.
260	3.0902E-01	-9.5106E-01	-8.3333E-02	2.0000E+00	3.4907E-02	3.0902E-01	-9.5106E-01	0.
270	1.0453E-01	-9.9452E-01	-8.3333E-02	2.0000E+00	3.4907E-02	1.0453E-01	-9.9452E-01	0.

SURFACE NORMAL VELOCITY BOUNDARY CONDITION

SURFACE VELOCITIES(REAL PART, IMAGINARY PART)

REGION = 1

	V(1)		V(2)		V(3)		V(4)
0.	0.	0.	0.	0.	0.	0.	0.
	V(5)		V(6)		V(7)		V(8)
0.	0.	0.	0.	0.	0.	0.	0.
	V(9)		V(10)		V(11)		V(12)
0.	0.	0.	0.	0.	0.	0.	0.
	V(13)		V(14)		V(15)		V(16)
0.	0.	0.	0.	0.	0.	0.	0.
	V(17)		V(18)		V(19)		V(20)
0.	0.	0.	0.	0.	0.	0.	0.
	V(21)		V(22)		V(23)		V(24)
0.	0.	0.	0.	0.	0.	0.	0.
	V(25)		V(26)		V(27)		V(28)
0.	0.	0.	0.	0.	0.	0.	0.
	V(29)		V(30)		V(31)		V(32)
0.	0.	0.	0.	0.	0.	0.	0.
	V(33)		V(34)		V(35)		V(36)
0.	0.	0.	0.	0.	0.	0.	0.
	V(37)		V(38)		V(39)		V(40)
0.	0.	0.	0.	0.	0.	0.	0.
	V(41)		V(42)		V(43)		V(44)
0.	0.	0.	0.	0.	0.	0.	0.
	V(45)		V(46)		V(47)		V(48)
0.	0.	0.	0.	0.	0.	0.	0.
	V(49)		V(50)		V(51)		V(52)
0.	0.	0.	0.	0.	0.	0.	0.

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           V( 53)                   V( 54)                   V( 55)                   V( 56)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 57)                   V( 58)                   V( 59)                   V( 60)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 61)                   V( 62)                   V( 63)                   V( 64)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 65)                   V( 66)                   V( 67)                   V( 68)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 69)                   V( 70)                   V( 71)                   V( 72)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 73)                   V( 74)                   V( 75)                   V( 76)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 77)                   V( 78)                   V( 79)                   V( 80)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 81)                   V( 82)                   V( 83)                   V( 84)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 85)                   V( 86)                   V( 87)                   V( 88)
     0.           0.          0.           0.          0.           0.          0.           0.
           V( 89)                   V( 90)
     0.           0.          0.           0.

REGION =  2

           V( 91)                   V( 92)                   V( 93)                   V( 94)
 -5.4192E-01  8.3391E-01  -5.5240E-01  7.7419E-01  -5.6106E-01  6.5970E-01  -5.4721E-01  5.0282E-01
           V( 95)                   V( 96)                   V( 97)                   V( 98)
 -4.8914E-01  3.2594E-01  -3.7355E-01  1.6091E-01  -2.0343E-01  4.2916E-02   4.3205E-08  1.8667E-15
           V( 99)                   V(100)                   V(101)                   V(102)
  2.0343E-01  4.2317E-02   3.7355E-01  1.6091E-01   4.8914E-01  3.2594E-01   5.4721E-01  5.0282E-01
           V(103)                   V(104)                   V(105)                   V(106)
  5.6106E-01  6.5973E-01   5.5240E-01  7.7419E-01   5.4192E-01  8.3391E-01  -5.4192E-01  8.3391E-01
           V(107)                   V(108)                   V(109)                   V(110)
 -5.5240E-01  7.7419E-01  -5.6106E-01  6.5970E-01  -5.4721E-01  5.0282E-01  -4.8914E-01  3.2594E-01
           V(111)                   V(112)                   V(113)                   V(114)
 -3.7355E-01  1.5391E-01  -2.0343E-01  4.2916E-02   4.3205E-08  1.8667E-15   2.0343E-01  4.2917E-02
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V(115)	V(116)	V(117)	V(118)
5.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01
V(119)	V(120)	V(121)	V(122)
5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01
V(123)	V(124)	V(125)	V(126)
-5.6106E-01 6.5970E-01	-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01
V(127)	V(128)	V(129)	V(130)
-2.0343E-01 4.2916E-02	4.3205E-08 1.8667E-15	2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01
V(131)	V(132)	V(133)	V(134)
4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01
V(135)	V(136)	V(137)	V(138)
5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01	-5.6106E-01 6.5970E-01
V(139)	V(140)	V(141)	V(142)
-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01	-2.0343E-01 4.2916E-02
V(143)	V(144)	V(145)	V(146)
4.3205E-08 1.8567E-15	2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01
V(147)	V(148)	V(149)	V(150)
5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01
V(151)	V(152)	V(153)	V(154)
-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01	-5.6106E-01 6.5970E-01	-5.4721E-01 5.0282E-01
V(155)	V(156)	V(157)	V(158)
-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01	-2.0343E-01 4.2916E-02	4.3205E-08 1.8667E-15
V(159)	V(160)	V(161)	V(162)
2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01
V(163)	V(164)	V(165)	V(166)
5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01
V(167)	V(168)	V(169)	V(170)
-5.5240E-01 7.7419E-01	-5.6106E-01 6.5970E-01	-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01
V(171)	V(172)	V(173)	V(174)
-3.7355E-01 1.6091E-01	-2.0343E-01 4.2916E-02	4.3205E-08 1.8667E-15	2.0343E-01 4.2917E-02
V(175)	V(176)	V(177)	V(178)
3.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01

V(179)	V(180)	V(181)	V(182)
5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01
V(183)	V(184)	V(185)	V(186)
-5.6106E-01 6.5970E-01	-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01
V(187)	V(188)	V(189)	V(190)
-2.0343E-01 4.2916E-02	4.3205E-08 1.8667E-15	2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01
V(191)	V(192)	V(193)	V(194)
4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01
V(195)	V(196)	V(197)	V(198)
5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01	-5.6106E-01 6.5970E-01
V(199)	V(200)	V(201)	V(202)
-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01	-2.0343E-01 4.2916E-02
V(203)	V(204)	V(205)	V(206)
4.3205E-08 1.8667E-15	2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01
V(207)	V(208)	V(209)	V(210)
5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01
V(211)	V(212)	V(213)	V(214)
-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01	-5.6106E-01 6.5970E-01	-5.4721E-01 5.0282E-01
V(215)	V(216)	V(217)	V(218)
-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01	-2.0343E-01 4.2916E-02	4.3205E-08 1.8667E-15
V(219)	V(220)	V(221)	V(222)
2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01
V(223)	V(224)	V(225)	V(226)
5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01
V(227)	V(228)	V(229)	V(230)
-5.5240E-01 7.7419E-01	-5.6106E-01 6.5970E-01	-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01
V(231)	V(232)	V(233)	V(234)
-3.7355E-01 1.6091E-01	-2.0343E-01 4.2916E-02	4.3205E-08 1.8667E-15	2.0343E-01 4.2917E-02
V(235)	V(236)	V(237)	V(238)
3.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01
V(239)	V(240)	V(241)	V(242)
5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01
V(243)	V(244)	V(245)	V(246)
-5.6106E-01 6.5970E-01	-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01

V(247)	V(248)	V(249)	V(250)
-2.0343E-01 4.2916E-02	4.3205E-08 1.8667E-15	2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01
V(251)	V(252)	V(253)	V(254)
4.8914E-01 3.2594E-01	5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01
V(255)	V(256)	V(257)	V(258)
5.4192E-01 8.3391E-01	-5.4192E-01 8.3391E-01	-5.5240E-01 7.7419E-01	-5.6106E-01 6.5970E-01
V(259)	V(260)	V(261)	V(262)
-5.4721E-01 5.0282E-01	-4.8914E-01 3.2594E-01	-3.7355E-01 1.6091E-01	-2.0343E-01 4.2916E-02
V(263)	V(264)	V(265)	V(266)
4.3205E-08 1.8667E-15	2.0343E-01 4.2917E-02	3.7355E-01 1.6091E-01	4.8914E-01 3.2594E-01
V(267)	V(258)	V(269)	V(270)
5.4721E-01 5.0282E-01	5.6106E-01 6.5970E-01	5.5240E-01 7.7419E-01	5.4192E-01 8.3391E-01

```
ENTER SUBROUTINE FOR ITERATIVE SOLUTION FOR SURFACE PRESSURE

 REQUESTED LIMIT ON NUMBER OF ITERATIONS =  30

 RELAXATION FACTOR SPECIFIED IS

   REAL PART  IMAGINARY PART
  5.0000E-01      0.

 CONVERGENCE CRITERION =  1.0000E-04


BEGIN ITERATION

 TIME =       2.429E+02 SECONDS

 MAXIMUM DIFFERENCE BETWEEN COMPONENTS

        OF SUCCESSIVE VECTORS
             1.1941E+00

             1.6728E-01

             8.7602E-02

             4.1245E-02

             1.8887E-02

             9.8482E-03

             5.8723E-03

             3.7346E-03

             2.4239E-03

             1.5919E-03

             1.0553E-03

             7.0459E-04

             4.7298E-04

             3.1873E-04

             2.1537E-04

             1.4579E-04

             9.8818E-05

 ITERATION TERMINATED BY CONVERGENCE CRITERION BEING MET

 TIME AT TERMINATION IS       4.820E+02 SECONDS
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SURFACE PRESSURES(REAL PART, IMAGINARY PART)

REGION = 1

P(1)		P(2)		P(3)		P(4)	
-1.3145E-01	1.0243E-01	-1.3091E-01	1.0224E-01	-1.2985E-01	1.0189E-01	-1.2831E-01	1.0137E-01
P(5)		P(6)		P(7)		P(8)	
-1.2634E-01	1.0073E-01	-1.2400E-01	9.9986E-02	-1.2139E-01	9.9181E-02	-1.1861E-01	9.8351E-02
P(9)		P(10)		P(11)		P(12)	
-1.1578E-01	9.7535E-02	-1.1303E-01	9.6768E-02	-1.1048E-01	9.6080E-02	-1.0826E-01	9.5500E-02
P(13)		P(14)		P(15)		P(16)	
-1.0649E-01	9.5046E-02	-1.0526E-01	9.4735E-02	-1.0462E-01	9.4578E-02	-1.5325E-01	1.1262E-01
P(17)		P(18)		P(19)		P(20)	
-1.5194E-01	1.1203E-01	-1.4931E-01	1.1079E-01	-1.4537E-01	1.0905E-01	-1.4017E-01	1.0688E-01
P(21)		P(22)		P(23)		P(24)	
-1.3378E-01	1.0441E-01	-1.2636E-01	1.0178E-01	-1.1815E-01	9.9127E-02	-1.0949E-01	9.6594E-02
P(25)		P(26)		P(27)		P(28)	
-1.0078E-01	9.4298E-02	-9.2483E-02	9.2326E-02	-8.5092E-02	9.0732E-02	-7.9068E-02	8.9540E-02
P(29)		P(30)		P(31)		P(32)	
-7.4809E-02	8.8753E-02	-7.2602E-02	8.8363E-02	-1.6985E-01	1.2513E-01	-1.6817E-01	1.2498E-01
P(33)		P(34)		P(35)		P(36)	
-1.6473E-01	1.2272E-01	-1.5937E-01	1.1947E-01	-1.5195E-01	1.1539E-01	-1.4237E-01	1.1073E-01
P(37)		P(38)		P(39)		P(40)	
-1.3071E-01	1.0575E-01	-1.1722E-01	1.0083E-01	-1.0242E-01	9.6224E-02	-8.7042E-02	9.2204E-02
P(41)		P(42)		P(43)		P(44)	
-7.2013E-02	8.8924E-02	-5.8344E-02	8.6437E-02	-4.7033E-02	8.4704E-02	-3.8952E-02	8.3636E-02
P(45)		P(46)		P(47)		P(48)	
-3.4741E-02	8.3132E-02	-1.8057E-01	1.4455E-01	-1.7900E-01	1.4278E-01	-1.7562E-01	1.3929E-01
P(49)		P(50)		P(51)		P(52)	
-1.6995E-01	1.3417E-01	-1.6147E-01	1.2763E-01	-1.4969E-01	1.2004E-01	-1.3439E-01	1.1190E-01
P(53)		P(54)		P(55)		P(56)	
-1.1572E-01	1.0382E-01	-9.4326E-02	9.6392E-02	-7.1349E-02	9.0115E-02	-4.8318E-02	8.5261E-02
P(57)		P(58)		P(59)		P(60)	
-2.6987E-02	8.1561E-02	-9.1134E-03	7.9733E-02	3.7620E-03	7.8574E-02	1.0501E-02	7.8085E-02

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        P( 61)                  P( 62)                  P( 63)                  P( 64)
-1.8370E-01  1.7183E-01  -1.8287E-01  1.6857E-01  -1.8067E-01  1.6360E-01  -1.7617E-01  1.5611E-01
        P( 65)                  P( 66)                  P( 67)                  P( 68)
-1.6815E-01  1.4627E-01  -1.5545E-01  1.3454E-01  -1.3726E-01  1.2172E-01  -1.1341E-01  1.0889E-01
        P( 69)                  P( 70)                  P( 71)                  P( 72)
-8.4643E-02  9.7165E-02  -5.2596E-02  8.7481E-02  -1.9651E-02  8.0345E-02   1.1381E-02  7.5757E-02
        P( 73)                  P( 74)                  P( 75)                  P( 76)
 3.7665E-02  7.3271E-02   5.6721E-02  7.2194E-02   6.6728E-02  7.1859E-02  -1.7493E-01  2.1318E-01
        P( 77)                  P( 78)                  P( 79)                  P( 80)
-1.7581E-01  2.0990E-01  -1.7663E-01  2.0306E-01  -1.7566E-01  1.9233E-01  -1.7059E-01  1.7761E-01
        P( 81)                  P( 82)                  P( 83)                  P( 84)
-1.5903E-01  1.5939E-01  -1.3905E-01  1.3888E-01  -1.0983E-01  1.1798E-01  -7.2067E-02  9.8788E-02
        P( 85)                  P( 86)                  P( 87)                  P( 88)
-2.8117E-02  8.3118E-02   1.8328E-02  7.1948E-02   6.2818E-02  6.5287E-02   1.0087E-01  6.2216E-02
        P( 89)                  P( 90)
 1.2859E-01  6.1335E-02   1.4319E-01  6.1302E-02

REGION =  2

        P( 91)                  P( 92)                  P( 93)                  P( 94)
-4.1518E-02  4.5234E-01  -5.5059E-02  4.4756E-01  -7.9402E-02  4.3553E-01  -1.0896E-01  4.1229E-01
        P( 95)                  P( 96)                  P( 97)                  P( 98)
-1.3545E-01  3.7420E-01  -1.4892E-01  3.2003E-01  -1.3977E-01  2.5244E-01  -1.0149E-01  1.7814E-01
        P( 99)                  P(100)                  P(101)                  P(102)
-3.3078E-02  1.0625E-01   6.0037E-02  4.5514E-02   1.6702E-01  1.5504E-03   2.7416E-01 -2.4664E-02
        P(103)                  P(104)                  P(105)                  P(106)
 3.6782E-01 -3.6410E-02   4.3669E-01 -3.9363E-02   4.7304E-01 -3.9135E-02   1.7833E-02  5.6113E-01
        P(107)                  P(108)                  P(109)                  P(110)
-2.9888E-04  5.5489E-01  -3.3068E-02  5.3927E-01  -7.3351E-02  5.0923E-01  -1.1064E-01  4.6028E-01
        P(111)                  P(112)                  P(113)                  P(114)
-1.3228E-01  3.9860E-01  -1.2611E-01  3.0383E-01  -8.3812E-02  2.0837E-01  -3.9548E-03  1.1575E-01
        P(115)                  P(116)                  P(117)                  P(118)
 1.0689E-01  3.7857E-02   2.3544E-01 -2.0548E-02   3.6480E-01 -5.5679E-02   4.7817E-01 -7.2282E-02
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P(119)		P(120)		P(121)		P(122)	
5.6166E-01	-7.7327E-02	6.0577E-01	-7.7741E-02	4.9372E-02	6.4488E-01	2.8832E-02	6.3716E-01
P(123)		P(124)		P(125)		P(126)	
-8.2599E-03	6.1827E-01	-5.3827E-02	5.8276E-01	-9.6026E-02	5.2568E-01	-1.2071E-01	4.4549E-01
P(127)		P(128)		P(129)		P(130)	
-1.1431E-01	3.4508E-01	-6.7625E-02	2.3697E-01	2.0918E-02	1.3100E-01	1.4403E-01	4.0525E-02
P(131)		P(132)		P(133)		P(134)	
2.3695E-01	-2.6419E-02	4.3094E-01	-6.8145E-02	5.5726E-01	-8.8848E-02	6.5036E-01	-9.6080E-02
P(135)		P(136)		P(137)		P(138)	
6.9958E-01	-9.7392E-02	5.7735E-02	7.1438E-01	4.5822E-02	7.0529E-01	6.3293E-03	6.8353E-01
P(139)		P(140)		P(141)		P(142)	
-4.2015E-02	6.4346E-01	-8.6487E-02	[illegible].8002E-01	-1.1198E-01	4.9176E-01	-1.0408E-01	3.8300E-01
P(143)		P(144)		P(145)		P(146)	
-5.3081E-02	2.5394E-01	4.2617E-02	1.4825E-01	1.7519E-01	4.9094E-02	3.2890E-01	-2.4931E-02
P(147)		P(148)		P(149)		P(150)	
4.8370E-01	-7.1900E-02	5.1954E-01	-9.6092E-02	7.1971E-01	-1.0536E-01	7.7268E-01	-1.0758E-01
P(151)		P(152)		P(153)		P(154)	
7.8483E-02	7.7356E-01	5.5784E-02	7.6326E-01	1.4966E-02	7.3901E-01	-3.4775E-02	6.9510E-01
P(155)		P(156)		P(157)		P(158)	
-8.0107E-02	6.2647E-01	-1.0527E-01	5.3182E-01	-9.5318E-02	4.1579E-01	-4.0238E-02	2.8986E-01
P(159)		P(160)		P(161)		P(162)	
6.1557E-02	1.5591E-01	2.0181E-01	6.0017E-02	3.6404E-01	-1.9605E-02	5.2729E-01	-7.0844E-02
P(163)		P(164)		P(165)		P(166)	
6.7053E-01	-9.7999E-02	7.7617E-01	-1.0907E-01	8.3205E-01	-1.1214E-01	8.4528E-02	8.2416E-01
P(167)		P(168)		P(169)		P(170)	
5.1398E-02	8.1279E-01	1.9898E-02	7.8641E-01	-3.0436E-02	7.3929E-01	-7.5839E-02	6.6640E-01
P(171)		P(172)		P(173)		P(174)	
-1.0010E-01	5.5663E-01	-8.7912E-02	4.4478E-01	-2.9064E-02	3.1201E-01	7.7939E-02	1.8297E-01
P(175)		P(176)		P(177)		P(178)	
2.2453E-01	7.1737E-02	3.9367E-01	-1.2380E-02	5.6369E-01	-6.7120E-02	7.1282E-01	-9.6768E-02
P(179)		P(180)		P(181)		P(182)	
8.2280E-01	-1.0341E-01	8.8098E-01	-1.1322E-01	8.7623E-02	8.6699E-01	6.4278E-02	8.5473E-01
P(183)		P(184)		P(185)		P(186)	
2.2484E-02	8.2556E-01	-2.7978E-02	7.7677E-01	-7.3029E-02	7.0040E-01	-9.6142E-02	5.9644E-01

P(187)	P(188)	P(189)	P(190)
-8.1758E-02 4.7000E-01	-1.9562E-02 3.3242E-01	9.1871E-02 1.9871E-01	2.4371E-01 8.3227E-02
P(191)	P(192)	P(193)	P(194)
4.1847E-01 -4.5025E-03	5.9394E-01 -6.2096E-02	7.4778E-01 -9.3810E-02	8.6123E-01 -1.0777E-01
P(195)	P(196)	P(197)	P(198)
9.2124E-01 -1.1222E-01	8.8910E-02 9.0247E-01	6.5480E-02 8.8947E-01	2.3617E-02 8.5984E-01
P(199)	P(200)	P(201)	P(202)
-2.6721E-02 8.0788E-01	-7.1227E-02 7.2871E-01	-9.3152E-02 6.2143E-01	-7.6768E-02 4.9134E-01
P(203)	P(204)	P(205)	P(206)
-1.1695E-02 3.4938E-01	1.0342E-01 2.1259E-01	2.5952E-01 9.3754E-02	4.3880E-01 3.1562E-03
P(207)	P(208)	P(209)	P(210)
6.1862E-01 -5.5723E-02	7.7621E-01 -9.0114E-02	8.9240E-01 -1.0516E-01	9.5387E-01 -1.1013E-01
P(211)	P(212)	P(213)	P(214)
8.9173E-02 9.3076E-01	6.5730E-02 9.1720E-01	2.3912E-02 8.8641E-01	-2.6192E-02 8.3275E-01
P(215)	P(216)	P(217)	P(218)
-7.0116E-02 7.5140E-01	-9.0955E-02 6.4156E-01	-7.2867E-02 5.0865E-01	-5.4383E-03 3.6439E-01
P(219)	P(220)	P(221)	P(222)
1.1262E-01 2.2418E-01	2.7209E-01 1.0277E-01	4.5490E-01 9.9607E-03	6.3809E-01 -5.1694E-02
P(223)	P(224)	P(225)	P(226)
7.9858E-01 -8.5395E-02	9.1689E-01 -1.0229E-01	9.7948E-01 -1.0769E-01	8.8951E-02 9.5200E-01
P(227)	P(228)	P(229)	P(230)
6.5528E-02 9.3799E-01	2.3800E-02 9.0633E-01	-2.6057E-02 8.5142E-01	-6.9465E-02 7.6847E-01
P(231)	P(232)	P(233)	P(234)
-8.9417E-02 6.5675E-01	-6.9995E-02 5.2179E-01	-7.6750E-04 3.7541E-01	1.1950E-01 2.3316E-01
P(235)	P(236)	P(237)	P(238)
2.8148E-01 1.3987E-01	4.6689E-01 1.5444E-02	6.5257E-01 -4.7513E-02	8.1517E-01 -8.3181E-02
P(239)	P(240)	P(241)	P(242)
3.3503E-01 -9.3711E-02	9.9843E-01 -1.0542E-01	8.8614E-02 9.6615E-01	6.5217E-02 9.5185E-01
P(243)	P(244)	P(245)	P(246)
2.3573E-02 9.1963E-01	-2.6087E-02 8.6389E-01	-6.9117E-02 7.7989E-01	-8.8444E-02 6.6693E-01
P(247)	P(248)	P(249)	P(250)
-6.8107E-02 5.3062E-01	2.3349E-03 3.8287E-01	1.2408E-01 2.3927E-01	2.8772E-01 1.1476E-01

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        P(251)                  P(252)                  P(253)                  P(254)
 4.7485E-01  1.3276E-02   6.6216E-01 -4.4536E-02   8.2615E-01 -8.0841E-02   9.4703E-01 -9.7790E-02
        P(255)                  P(256)                  P(257)                  P(258)
 1.0110E+00 -1.1376E-01   8.8387E-02  9.7322E-01   6.5008E-02  9.5878E-01   2.3412E-02  9.2628E-01
        P(259)                  P(260)                  P(261)                  P(262)
-2.6140E-02  8.7813E-01  -6.8971E-02  7.8560E-01  -8.7976E-02  6.7204E-01  -6.7174E-02  5.3506E-01
        P(263)                  P(264)                  P(265)                  P(266)
 3.8798E-03  3.9563E-01   1.2637E-01  2.4237E-01   2.9083E-01  1.1725E-01   4.7881E-01  2.1242E-02
        P(267)                  P(268)                  P(269)                  P(270)
 6.6693E-01 -4.2994E-02   8.3161E-01 -7.9615E-02   9.5300E-01 -9.6772E-02   1.0172E+00 -1.0279E-01

FAR-FIELD PRESSURES AT THE SURFACE OF A LARGE SPHERE CENTERED AROUND THE BODY

COLATITUDE = 0.        DEG

     LONGITUDE        (0.        DEG)

               REAL       IMAGINARY       REAL       IMAGINARY       REAL       IMAGINARY       REAL       IMAGINARY
            6.5187E-01  5.5362E+00

COLATITUDE = 5.000E+00 DEG

     LONGITUDE        (0.        DEG)          (3.000E+01DEG)          (1.800E+02DEG)          (2.700E+02DEG)

               REAL       IMAGINARY       REAL       IMAGINARY       REAL       IMAGINARY       REAL       IMAGINARY
            6.6782E-01  5.5609E+00   4.6152E-01  6.1453E+00   6.6782E-01  5.5609E+00   8.7617E-01  4.9340E+00

COLATITUDE = 1.000E+01 DEG

     LONGITUDE        (0.        DEG)          (3.000E+01DEG)          (1.800E+02DEG)          (2.700E+02DEG)

               REAL       IMAGINARY       REAL       IMAGINARY       REAL       IMAGINARY       REAL       IMAGINARY
            7.1570E-01  5.6340E+00   3.0310E-01  6.7718E+00   7.1570E-01  5.6340E+00   1.1365E+00  4.3251E+00
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COLATITUDE = 1.500E+01 DEG

LONGITUDE	(0. DEG)		(9.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	7.9544E-01	5.7530E+00	1.7486E-01	7.4220E+00	7.9544E-01	5.7530E+00	1.4347E+00	3.6940E+00

COLATITUDE = 2.000E+01 DEG

LONGITUDE	(0. DEG)		(9.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	9.0682E-01	5.3140E+00	7.5488E-02	8.0977E+00	9.0682E-01	5.9140E+00	1.7718E+00	3.0251E+00

COLATITUDE = 2.500E+01 DEG

LONGITUDE	(0. DEG)		(9.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	1.0492E+00	6.1113E+00	4.0840E-03	8.7958E+00	1.0492E+00	6.1113E+00	2.1475E+00	2.3041E+00

COLATITUDE = 3.000E+01 DEG

LONGITUDE	(0. DEG)		(9.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	1.2212E+00	6.3382E+00	-4.0024E-02	9.5088E+00	1.2212E+00	6.3382E+00	2.5599E+00	1.5205E+00

COLATITUDE = 3.500E+01 DEG

LONGITUDE	(0. DEG)		(9.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	1.4204E+00	6.5871E+00	-5.7534E-02	1.0226E+01	1.4204E+00	6.5871E+00	3.0050E+00	6.6872E-01

COLATITUDE = 4.000E+01 DEG

LONGITUDE	(0. DEG)		(9.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
Ah	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	1.6433E+00	6.8493E+00	-6.9514E-02	1.0932E+01	1.6433E+00	6.8493E+00	3.4762E+00	-2.4970E-01

COLATITUDE = 4.500E+01 DEG

LONGITUDE	(0.	DEG)	(3.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	1.8847E+00	7.1164E+00	-1.7760E-02	1.1613E+01	1.8847E+00	7.1164E+00	3.9646E+00	-1.2253E+00

COLATITUDE = 5.000E+01 DEG

LONGITUDE	(0.	DEG)	(3.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	2.1381E+00	7.3795E+00	3.4888E-02	1.2253E+01	2.1381E+00	7.3795E+00	4.4590E+00	-2.2400E+00

COLATITUDE = 5.500E+01 DEG

LONGITUDE	(0.	DEG)	(3.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	2.3954E+00	7.6305E+00	1.0435E-01	1.2839E+01	2.3954E+00	7.6305E+00	4.9460E+00	-3.2676E+00

COLATITUDE = 6.000E+01 DEG

LONGITUDE	(0.	DEG)	(3.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	2.6474E+00	7.5621E+00	1.8530E-01	1.3358E+01	2.6474E+00	7.8621E+00	5.4100E+00	-4.2747E+00

COLATITUDE = 6.500E+01 DEG

LONGITUDE	(0.	DEG)	(3.000E+01DEG)		(1.800E+02DEG)		(2.700E+02DEG)	
	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
	2.8841E+00	8.0680E+00	2.7131E-01	1.3804E+01	2.8841E+00	8.0680E+00	5.8381E+00	-5.2231E+00

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COLATITUDE = 7.000E+01 DEG

     LONGITUDE        (0.        DEG)          (3.000E+01DEG)          (1.800E+02DEG)          (2.700E+02DEG)

                    REAL       IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY
                 3.0952E+00  8.2428E+00  3.5528E-01  1.4169E+01  3.0952E+00  8.2428E+00  6.2128E+00 -6.0721E+00

COLATITUDE = 7.500E+01 DEG

     LONGITUDE        (0.        DEG)          (3.000E+01DEG)          (1.800E+02DEG)          (2.700E+02DEG)

                    REAL       IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY
                 3.2713E+00  8.3825E+00  4.3001E-01  1.4453E+01  3.2713E+00  8.3825E+00  6.5207E+00 -6.7820E+00

COLATITUDE = 8.000E+01 DEG

     LONGITUDE        (0.        DEG)          (3.000E+01DEG)          (1.800E+02DEG)          (2.700E+02DEG)

                    REAL       IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY
                 3.4037E+00  8.4842E+00  4.8888E-01  1.4655E+01  3.4037E+00  8.4842E+00  6.7499E+00 -7.3174E+00

COLATITUDE = 8.500E+01 DEG

     LONGITUDE        (0.        DEG)          (3.000E+01DEG)          (1.800E+02DEG)          (2.700E+02DEG)

                    REAL       IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY
                 3.4860E+00  8.5460E+00  5.2653E-01  1.4776E+01  3.4860E+00  8.5460E+00  6.8913E+00 -7.6507E+00

COLATITUDE = 9.000E+01 DEG

     LONGITUDE        (0.        DEG)          (3.000E+01DEG)          (1.800E+02DEG)          (2.700E+02DEG)

                    REAL       IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY     REAL      IMAGINARY
                 3.5139E+00  8.5667E+00  5.3948E-01  1.4816E+01  3.5139E+00  8.5667E+00  6.9391E+00 -7.7638E+00

ELAPSED TIME AT EXIT FROM KWAVE =     5.425E+02   SECONDS
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SCATTERING APPLICATIONS

TITLE SAMPLE PROBLEM 2 DATE

PROBLEM SHEET 1 OF 3

XWAVE DATA

PROBLEM TITLE

ΔΔΔΔΔΔΔΔΔΔΔΔ FINITE CYLINDER - RADIUS = 1, LENGTH = 4

13

CASE TITLE

ΔΔΔΔΔΔΔΔΔΔΔΔ RIGID-BODY SCATTERING OF PLANE WAVE FROM Z(-) DIRECTION

13

DIMENSIONS FOR XWAVE

D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14
0024	0012	0169	0003	0009								0091	0001
1	5	9	13	17	21	25	29	33	37	41	45	49	53 56

MISCELLANEOUS DATA

$\underline{k}_i$		c	ρ	H (REAL)	H (IMAG)	ITERATION LIMIT	CONVERGENCE CRITERION
2.0	ΔΔΔΔΔΔΔΔ			0.5	0.0	0030	0.0001
1	9	17	25	33	41	49	53 60

PROGRAM OPTIONS

OPT1	OPT2	OPT3	OPT4	OPT5	OPT6	OPT7	OPT8	OPT9	OPT10
0000	0001	0001	0005	0001	0001	0000	0002	0000	0001
1	5	9	13	17	21	25	29	33	37 40

INCIDENT PLANE WAVE DATA

$\underline{k}_{i_x}$		$\underline{k}_{i_y}$		$\underline{k}_{i_z}$		$\bar{P}_i$
0.0	ΔΔ	0.0	ΔΔ	2.0	ΔΔΔΔ	2.0
1	8	11	18	21	28	33 40

SYMMETRY OPTIONS

yz-PLANE	xz-PLANE	LONG.	RADIAL
			0001
1	5	9	13

DATA INPUT FORM (1)

PIECEWISE CONICAL SHELL SURFACE

TITLE SAMPLE PROBLEM 2

PROBLEM

DATE

SHEET 2 OF 3

XWAVE DATA

NUMBER OF REGIONS

1–4
0003

REGION: EXTENT AND MODELING

r_1 (1)	r_2 (9)	θ_1 (17)	θ_2 (25)	z_1 (33)	z_2 (41)	n (49)	m	SIGN (57–64)
0.0	1.0	0.0	90.0	-2.0	-2.0	0006	0009	-1.0

NORMAL SURFACE VELOCITY

V_n (REAL) (1–8)		V_n (IMAG.) (11–18)
	∞	

REGION: EXTENT AND MODELING

r_1 (1)	r_2 (9)	θ_1 (17)	θ_2 (25)	z_1 (33)	z_2 (41)	n (49)	m (53)	SIGN (57–64)
1.0	1.0	0.0	90.0	-2.0	2.0	0012	0005	

NORMAL SURFACE VELOCITY

V_n (REAL) (1–8)		V_n (IMAG.) (11–18)
	∞	

REGION: EXTENT AND MODELING

r_1 (1)	r_2 (9)	θ_1 (17)	θ_2 (25)	z_1 (33)	z_2 (41)	n (49)	m (53)	SIGN (57–64)
0.0	1.0	0.0	90.0	2.0	2.0	0006	0009	1.0

NORMAL SURFACE VELOCITY

V_n (REAL) (1–8)		V_n (IMAG.) (11–18)
	∞	

DATA INPUT FORM (2)

FAR-FIELD PRESSURE CALCULATION

TITLE SAMPLE PROBLEM 2 DATE

PROBLEM SHEET 3 OF 3

XWAVE DATA

AUTOMATIC FAR FIELD POINT GENERATION

NFFLAT	NFFLNG		LATLIM	LONGLIM
091	001	000	180.0	0.0
1	4	7	10	18 25

ARBITRARY FAR-FIELD POINT SPECIFICATION

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

ψ_{FF}	ϕ_{FF}
1	9 16

DATA INPUT FORM (15)

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ELAPSED TIME AT ENTRY INTO XWAVE =    2.996E+01 SECONDS

THERE ARE 040672(OCTAL) WORDS OF OPEN-CORE AVAILABLE FOR THIS PROBLEM

CM REDUCED TO 062500(OCTAL)
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WAVE  SEPTEMBER 1975

 FINITE CYLINDER - RADIUS=1, LENGTH=4
 RIGID-BODY SCATTERING OF PLANE WAVE FROM Z(-) DIRECTION

DIMENSIONS FOR ARRAYS

 DIMENSION  1 =  24
 DIMENSION  2 =  12
 DIMENSION  3 = 168
 DIMENSION  4 =   3
 DIMENSION  5 =   9
 DIMENSION  6 =   1
 DIMENSION  7 =   1
 DIMENSION  8 =   1
 DIMENSION  9 =   1
 DIMENSION 10 =   1
 DIMENSION 11 =   1
 DIMENSION 12 =   1
 DIMENSION 13 =  91
 DIMENSION 14 =   1

OPTION DATA
OP1  OP2  OP3  OP4  OP5  OP6  OP7  OP8  OP9  OP10
 0    1    1    5    1    1    0    2    0    1

MAGNITUDE OF VECTOR WAVE NUMBER, K =  2.0000E+00

COMPONENTS OF VECTOR WAVE NUMBER K

 X-COMPONENT   Y-COMPONENT   Z-COMPONENT
  0.            0.            2.0000E+00


MAGNITUDE OF NONDIMENSIONALIZED INCIDENT PRESSURE WAVE =  1.0000E+00


SURFACE GEOMETRY AND BOUNDARY CONDITION SYMMETRIES

 ROTATIONAL SYMMETRY ABOUT Z-AXIS
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SURFACE MODEL GEOMETRY

SURFACE ELEMENT NO.	ELEMENT BASE POINT COORDINATES X	Y	Z	INVERSE CURVATURE AT BASE POINT	AREA OF ELEMENT	COORDINATES OF UNIT OUTWARD NORMAL AT BASE POINT X	Y	Z
1	7.2630E-03	8.3016E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
2	2.1568E-02	8.0494E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
3	3.5218E-02	7.5526E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
4	4.7798E-02	6.9253E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00

5	5.8926E-02	5.8926E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
6	6.8263E-02	4.7798E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
7	7.5526E-02	3.5218E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
8	8.0494E-02	2.1568E-02	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
9	8.3016E-02	7.2630E-03	-2.0000E+00	0.	2.4241E-03	0.	0.	-1.0000E+00
10	2.1789E-02	2.4905E-01	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
11	6.4705E-02	2.4148E-01	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
12	1.0565E-01	2.2658E-01	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
13	1.4339E-01	2.0479E-01	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
14	1.7678E-01	1.7678E-01	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
15	2.0479E-01	1.4339E-01	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
16	2.2658E-01	1.0565E-01	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
17	2.4148E-01	6.4705E-02	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
18	2.4905E-01	2.1789E-02	-2.0000E+00	0.	7.2722E-03	0.	0.	-1.0000E+00
19	3.6315E-02	4.1508E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
20	1.0784E-01	4.0247E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
21	1.7609E-01	3.7763E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
22	2.3899E-01	3.4131E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
23	2.9463E-01	2.9463E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
24	3.4131E-01	2.3899E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
25	3.7763E-01	1.7609E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
26	4.0247E-01	1.0734E-01	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00

27	4.1508E-01	3.6315E-02	-2.0000E+00	0.	1.2120E-02	0.	0.	-1.0000E+00
28	5.0841E-02	5.8111E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
29	1.5098E-01	5.6346E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
30	2.4653E-01	5.2868E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
31	3.3459E-01	4.7784E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
32	4.1248E-01	4.1248E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
33	4.7784E-01	3.3459E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
34	5.2868E-01	2.4653E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
35	5.6346E-01	1.5098E-01	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
36	5.8111E-01	5.0841E-02	-2.0000E+00	0.	1.6968E-02	0.	0.	-1.0000E+00
37	6.5367E-02	7.4715E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
38	1.9411E-01	7.2444E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
39	3.1696E-01	6.7973E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
40	4.3018E-01	6.1436E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
41	5.3033E-01	5.3033E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
42	6.1436E-01	4.3018E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
43	6.7973E-01	3.1696E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
44	7.2444E-01	1.9411E-01	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
45	7.4715E-01	6.5367E-02	-2.0000E+00	0.	2.1817E-02	0.	0.	-1.0000E+00
46	7.9893E-02	9.1318E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
47	2.3725E-01	8.8543E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
48	3.8740E-01	8.3078E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00

49	5.2578E-01	7.5989E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
50	6.4818E-01	6.4818E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
51	7.5989E-01	5.2578E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
52	8.3078E-01	3.8740E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
53	8.8543E-01	2.3725E-01	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
54	9.1318E-01	7.9893E-02	-2.0000E+00	0.	2.6665E-02	0.	0.	-1.0000E+00
55	1.5643E-01	9.8769E-01	-1.8333E+00	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
56	4.5399E-01	8.9101E-01	-1.8333E+00	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
57	7.0711E-01	7.0711E-01	-1.8333E+00	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
58	8.9101E-01	4.5399E-01	-1.8333E+00	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
59	9.8769E-01	1.5643E-01	-1.8333E+00	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
60	1.5643E-01	9.8769E-01	-1.5000E+00	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
61	4.5399E-01	8.9101E-01	-1.5000E+00	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
62	7.0711E-01	7.0711E-01	-1.5000E+00	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
63	8.9101E-01	4.5399E-01	-1.5000E+00	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
64	9.8769E-01	1.5643E-01	-1.5000E+00	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
65	1.5643E-01	9.8769E-01	-1.1667E+00	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
66	4.5399E-01	8.9101E-01	-1.1667E+00	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
67	7.0711E-01	7.0711E-01	-1.1667E+00	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
68	8.9101E-01	4.5399E-01	-1.1667E+00	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
69	9.8769E-01	1.5643E-01	-1.1667E+00	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
70	1.5643E-01	9.8769E-01	-8.3333E-01	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.

71	4.5399E-01	8.3101E-01	-8.3333E-01	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
72	7.0711E-01	7.0711E-01	-8.3333E-01	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
73	8.9101E-01	4.5339E-01	-8.3333E-01	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
74	9.8769E-01	1.5643E-01	-8.3333E-01	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
75	1.5643E-01	9.8759E-01	-5.0000E-01	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
76	4.5399E-01	8.9101E-01	-5.0000E-01	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
77	7.0711E-01	7.0711E-01	-5.0000E-01	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
78	8.9101E-01	4.5339E-01	-5.0000E-01	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
79	9.8769E-01	1.5643E-01	-5.0000E-01	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
80	1.5643E-01	9.8759E-01	-1.6667E-01	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
81	4.5399E-01	8.9101E-01	-1.6667E-01	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
82	7.0711E-01	7.0711E-01	-1.6667E-01	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
83	8.9101E-01	4.5399E-01	-1.6657E-01	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
84	9.8769E-01	1.5643E-01	-1.6667E-01	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
85	1.5643E-01	9.8759E-01	1.6667E-01	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
86	4.5399E-01	8.9101E-01	1.6667E-01	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
87	7.0711E-01	7.0711E-01	1.6667E-01	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
88	8.9101E-01	4.5399E-01	1.6667E-01	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
89	9.8769E-01	1.5643E-01	1.6667E-01	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
90	1.5643E-01	9.8769E-01	5.0000E-01	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
91	4.5399E-01	8.9101E-01	5.0000E-01	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
92	7.0711E-01	7.0711E-01	5.0000E-01	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.

93	8.9101E-01	4.5399E-01	5.0000E-01	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
94	9.8769E-01	1.5643E-01	5.0000E-01	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
95	1.5643E-01	9.8769E-01	8.3333E-01	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
96	4.5399E-01	8.9101E-01	8.3333E-01	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
97	7.0711E-01	7.0711E-01	8.3333E-01	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
98	8.9101E-01	4.5399E-01	8.3333E-01	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
99	9.8769E-01	1.5643E-01	8.3333E-01	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
100	1.5643E-01	9.8769E-01	1.1667E+00	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
101	4.5399E-01	8.9101E-01	1.1667E+00	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
102	7.0711E-01	7.0711E-01	1.1667E+00	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
103	8.9101E-01	4.5399E-01	1.1667E+00	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
104	9.8769E-01	1.5643E-01	1.1667E+00	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
105	1.5643E-01	9.8769E-01	1.5000E+00	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
106	4.5399E-01	8.9101E-01	1.5000E+00	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
107	7.0711E-01	7.0711E-01	1.5000E+00	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
108	8.9101E-01	4.5399E-01	1.5000E+00	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
109	9.8769E-01	1.5643E-01	1.5000E+00	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.
110	1.5643E-01	9.8769E-01	1.8333E+00	2.0000E+00	1.0472E-01	1.5643E-01	9.8769E-01	0.
111	4.5399E-01	8.9101E-01	1.8333E+00	2.0000E+00	1.0472E-01	4.5399E-01	8.9101E-01	0.
112	7.0711E-01	7.0711E-01	1.8333E+00	2.0000E+00	1.0472E-01	7.0711E-01	7.0711E-01	0.
113	8.9101E-01	4.5399E-01	1.8333E+00	2.0000E+00	1.0472E-01	8.9101E-01	4.5399E-01	0.
114	9.8769E-01	1.5643E-01	1.8333E+00	2.0000E+00	1.0472E-01	9.8769E-01	1.5643E-01	0.

115	7.2630E-03	8.3016E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
116	2.1568E-02	8.0494E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
117	3.5218E-02	7.5526E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
118	4.7798E-02	6.8263E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
119	5.8926E-02	5.8926E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
120	6.8263E-02	4.7798E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
121	7.5526E-02	3.5218E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
122	8.0494E-02	2.1568E-02	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
123	8.3016E-02	7.2630E-03	2.0000E+00	0.	2.4241E-03	0.	0.	1.0000E+00
124	2.1789E-02	2.4905E-01	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
125	6.4705E-02	2.4148E-01	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
126	1.0565E-01	2.2658E-01	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
127	1.4339E-01	2.0479E-01	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
128	1.7678E-01	1.7678E-01	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
129	2.0479E-01	1.4339E-01	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
130	2.2658E-01	1.0565E-01	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
131	2.4148E-01	6.4705E-02	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
132	2.4905E-01	2.1789E-02	2.0000E+00	0.	7.2722E-03	0.	0.	1.0000E+00
133	3.6315E-02	4.1508E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
134	1.0784E-01	4.0247E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
135	1.7609E-01	3.7753E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
136	2.3899E-01	3.4131E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00

137	2.9463E-01	2.9453E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
138	3.4131E-01	2.3899E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
139	3.7763E-01	1.7609E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
140	4.0247E-01	1.0794E-01	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
141	4.1508E-01	3.6315E-02	2.0000E+00	0.	1.2120E-02	0.	0.	1.0000E+00
142	5.0841E-02	5.8111E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
143	1.5098E-01	5.6346E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
144	2.4653E-01	5.2868E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
145	3.3459E-01	4.7784E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
146	4.1248E-01	4.1248E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
147	4.7784E-01	3.3459E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
148	5.2868E-01	2.4653E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
149	5.6346E-01	1.5098E-01	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
150	5.8111E-01	5.0841E-02	2.0000E+00	0.	1.6968E-02	0.	0.	1.0000E+00
151	6.5367E-02	7.4715E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
152	1.9411E-01	7.2444E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
153	3.1696E-01	6.7973E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
154	4.3018E-01	6.1436E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
155	5.3033E-01	5.3033E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
156	6.1436E-01	4.3018E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
157	6.7973E-01	3.1696E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
158	7.2444E-01	1.9411E-01	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00

159	7.4715E-01	6.5367E-02	2.0000E+00	0.	2.1817E-02	0.	0.	1.0000E+00
160	7.9893E-02	9.1318E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
161	2.3725E-01	8.8543E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
162	3.8740E-01	8.3078E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
163	5.2578E-01	7.5089E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
164	6.4818E-01	6.4818E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
165	7.5089E-01	5.2578E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
166	8.3078E-01	3.8740E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
167	8.8543E-01	2.3725E-01	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00
168	9.1318E-01	7.9893E-02	2.0000E+00	0.	2.6665E-02	0.	0.	1.0000E+00

```
SURFACE NORMAL VELOCITY BOUNDARY CONDITION

                         SURFACE VELOCITIES(   REAL PART, IMAGINARY PART   )

REGION =  1

              V(  1)                   V( 10)                   V( 19)                   V( 28)
     6.5364E-01  -7.5680E-01  6.5364E-01  -7.5680E-01  6.5364E-01  -7.5680E-01  6.5364E-01  -7.5680E-01
              V( 37)                   V( 46)
     6.5364E-01  -7.5680E-01  6.5364E-01  -7.5680E-01

REGION =  2

              V( 55)                   V( 60)                   V( 65)                   V( 70)
     0.            0.         0.            0.         0.            0.         0.            0.
              V( 75)                   V( 80)                   V( 85)                   V( 90)
     0.            0.         0.            0.         0.            0.         0.            0.
              V( 95)                   V(100)                   V(105)                   V(110)
     0.            0.         0.            0.         0.            0.         0.            0.

REGION =  3

              V(115)                   V(124)                   V(133)                   V(142)
    -6.5364E-01  -7.5680E-01 -6.5364E-01  -7.5680E-01 -6.5364E-01  -7.5680E-01 -6.5364E-01  -7.5680E-01
              V(151)                   V(160)
    -6.5364E-01  -7.5680E-01 -6.5364E-01  -7.5680E-01
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ENTER SUBROUTINE FOR ITERATIVE SOLUTION FOR SURFACE PRESSURE

 REQUESTED LIMIT ON NUMBER OF ITERATIONS =  30

 RELAXATION FACTOR SPECIFIED IS

   REAL PART  IMAGINARY PART
  5.0000E-01      0.

 CONVERGENCE CRITERION =  1.0000E-04


BEGIN ITERATION

 TIME =       4.226E+01 SECONDS

 MAXIMUM DIFFERENCE BETWEEN COMPONENTS

        OF SUCCESSIVE VECTORS
              1.8481E+00

              3.4754E-01

              2.1043E-01

              1.2960E-01

              1.3462E-01

              1.1783E-01

              8.5600E-02

              5.3122E-02

              2.8505E-02

              1.8429E-02

              1.3072E-02

              1.1641E-02

              1.1181E-02

              9.5544E-03

              7.3652E-03

              5.1845E-03

              3.4137E-03

              2.5287E-03

              1.9344E-03

              1.6008E-03

              1.4412E-03
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1.2180E-03
9.5654E-04
7.0552E-04
5.0331E-04
3.6766E-04
2.8880E-04
2.4205E-04
2.0424E-04
1.6682E-04

ITERATION TERMINATED BY LIMIT ON NO. OF ITERATIONS BEING MET

TIME AT TERMINATION IS      4.612E+01 SECONDS

                              SURFACE PRESSURES(   REAL PART, IMAGINARY PART   )

REGION =  1
                 P(  1)                    P( 10)                    P( 19)                    P( 28)
       1.9529E-02  -1.9351E+00    8.8563E-02  -1.7973E+00    1.0871E-01  -1.6320E+00    1.2243E-01  -1.4107E+00
                 P( 37)                    P( 46)
       1.4885E-01  -1.1321E+00    2.6677E-01  -8.0614E-01

REGION =  2
                 P( 55)                    P( 60)                    P( 65)                    P( 70)
       3.4097E-01  -1.0156E-01    2.0500E-01   3.9658E-02    4.0679E-02   7.4558E-02   -9.9925E-02   6.8821E-02
                 P( 75)                    P( 80)                    P( 85)                    P( 90)
      -1.7812E-01   5.3238E-02   -1.7445E-01   4.3429E-02   -9.4703E-02   4.0864E-02    3.0967E-02   3.5224E-02
                 P( 95)                    P(100)                    P(105)                    P(110)
       1.5617E-01   1.0304E-02    2.3004E-01  -4.8122E-02    2.0528E-01  -1.4546E-01    1.6994E-02  -2.7582E-01

REGION =  3
                 P(115)                    P(124)                    P(133)                    P(142)
      -2.0488E+00  -3.5180E-01   -1.8965E+00  -3.9437E-01   -1.7181E+00  -3.7918E-01   -1.4794E+00  -3.4465E-01
                 P(151)                    P(160)
      -1.1760E+00  -3.0946E-01   -7.9700E-01  -3.4154E-01
```

FAR-FIELD PRESSURES AT THE SURFACE OF A LARGE SPHERE CENTERED AROUND THE BODY

COLATITUDE = 0. DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.7174E+00	-4.4740E+00						

COLATITUDE = 2.000E+00 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.7097E+00	-4.4500E+00						

COLATITUDE = 4.000E+00 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.6864E+00	-4.3782E+00						

COLATITUDE = 6.000E+00 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.6471E+00	-4.2585E+00						

COLATITUDE = 8.000E+00 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.5911E+00	-4.0913E+00						

COLATITUDE = 1.000E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.5174E+00	-3.8767E+00						

COLATITUDE = 1.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.4249E+00	-3.6154E+00						

COLATITUDE = 1.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.3122E+00	-3.3081E+00						

COLATITUDE = 1.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.1782E+00	-2.9560E+00						

COLATITUDE = 1.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
6.0214E+00	-2.5608E+00						

```
COLATITUDE = 2.000E+01 DEG

     LONGITUDE        (0.        DEG)

                 REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY
              5.3407E+00  -2.1247E+00

COLATITUDE = 2.200E+01 DEG

     LONGITUDE        (0.        DEG)

                 REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY
              5.6350E+00  -1.6506E+00

COLATITUDE = 2.400E+01 DEG

     LONGITUDE        (0.        DEG)

                 REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY
              5.4038E+00  -1.1421E+00

COLATITUDE = 2.600E+01 DEG

     LONGITUDE        (0.        DEG)

                 REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY
              5.1467E+00  -6.0386E-01

COLATITUDE = 2.800E+01 DEG

     LONGITUDE        (0.        DEG)

                 REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY
              4.8639E+00  -4.1133E-02

COLATITUDE = 3.000E+01 DEG

     LONGITUDE        (0.        DEG)

                 REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY        REAL        IMAGINARY
              4.5562E+00   5.3979E-0[illegible]
```

COLATITUDE = 3.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
4.2247E+00	1.1317E+00						

COLATITUDE = 3.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
3.8717E+00	1.7266E+00						

COLATITUDE = 3.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
3.4996E+00	2.3157E+00						

COLATITUDE = 3.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
3.1119E+00	2.8896E+00						

COLATITUDE = 4.000E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
2.7125E+00	3.4382E+00						

COLATITUDE = 4.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
2.3061E+00	3.9513E+00						

COLATITUDE = 4.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
1.8976E+00	4.4157E+00						

COLATITUDE = 4.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
1.4925E+00	4.8303E+00						

COLATITUDE = 4.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
1.0965E+00	5.1763E+00						

COLATITUDE = 5.000E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
7.1549E-01	5.4481E+00						

COLATITUDE = 5.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
3.5508E-01	5.6378E+00						

COLATITUDE = 5.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
2.0752E-02	5.7390E+00						

COLATITUDE = 5.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.8249E-01	5.7470E+00						

COLATITUDE = 5.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-5.5027E-01	5.6587E+00						

COLATITUDE = 6.000E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-7.7900E-01	5.4739E+00						

COLATITUDE = 6.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-9.6602E-01	5.1919E+00						

COLATITUDE = 6.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.1097E+00	4.8180E+00						

COLATITUDE = 6.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.2097E+00	4.3573E+00						

COLATITUDE = 6.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.2666E+00	3.8177E+00						

COLATITUDE = 7.000E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.2823E+00	3.2089E+00						

COLATITUDE = 7.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.2598E+00	2.5428E+00						

COLATITUDE = 7.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.2034E+00	1.8327E+00						

COLATITUDE = 7.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.1179E+00	1.0931E+00						

COLATITUDE = 7.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.0094E+00	3.3967E-01						

COLATITUDE = 8.000E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-8.8406E-01	-4.1160E-01						

COLATITUDE = 8.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-7.4886E-01	-1.1444E+00						

COLATITUDE = 8.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-6.1076E-01	-1.8428E+00						

COLATITUDE = 8.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-4.7667E-01	-2.4915E+00						

COLATITUDE = 8.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-3.5322E-01	-3.0761E+00						

COLATITUDE = 9.000E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.4649E-01	-3.5838E+00						

COLATITUDE = 9.200E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.5188E-01	-4.0035E+00						

COLATITUDE = 9.400E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.0385E-01	-4.3261E+00						

COLATITUDE = 9.600E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-7.5851E-02	-4.5447E+00						

COLATITUDE = 9.800E+01 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-8.0162E-02	-4.6549E+00						

COLATITUDE = 1.000E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.1786E-01	-4.6548E+00						

COLATITUDE = 1.020E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.8878E-01	-4.5448E+00						

COLATITUDE = 1.040E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.9154E-01	-4.3288E+00						

COLATITUDE = 1.060E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-4.2364E-01	-4.0097E+00						

COLATITUDE = 1.080E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-5.8149E-01	-3.5976E+00						

COLATITUDE = 1.100E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-7.6063E-01	-3.1010E+00						

COLATITUDE = 1.120E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-9.5586E-01	-2.5311E+00						

COLATITUDE = 1.140E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.1614E+00	-1.9002E+00						

COLATITUDE = 1.160E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.3713E+00	-1.2219E+00						

COLATITUDE = 1.180E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.5791E+00	-5.1008E-01						

COLATITUDE = 1.200E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.7790E+00	2.2117E-01						

COLATITUDE = 1.220E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.9649E+00	9.5784E-01						

COLATITUDE = 1.240E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.1315E+00	1.6865E+00						

COLATITUDE = 1.260E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.2741E+00	2.3947E+00						

COLATITUDE = 1.280E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.3888E+00	3.0709E+00						

COLATITUDE = 1.300E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.4723E+00	3.7053E+00						

COLATITUDE = 1.[illegible]02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.5226E+00	4.2894E+00						

COLATITUDE = 1.340E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.5383E+00	4.8165E+00						

COLATITUDE = 1.360E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.5193E+00	5.2817E+00						

COLATITUDE = 1.380E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.4660E+00	5.6819E+00						

COLATITUDE = 1.400E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.3800E+00	6.0157E+00						

```
COLATITUDE = 1.420E+02 DEG

     LONGITUDE        (0.        DEG)

               REAL        IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
          -2.2635E+00   6.2834E+00

COLATITUDE = 1.440E+02 DEG

     LONGITUDE        (0.        DEG)

               REAL        IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
          -2.1195E+00   6.4867E+00

COLATITUDE = 1.460E+02 DEG

     LONGITUDE        (0.        DEG)

               REAL        IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
          -1.9513E+00   6.6290E+00

COLATITUDE = 1.480E+02 DEG

     LONGITUDE        (0.        DEG)

               REAL        IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
          -1.7628E+00   6.7144E+00

COLATITUDE = 1.500E+02 DEG

     LONGITUDE        (0.        DEG)

               REAL        IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
          -1.5583E+00   6.7483E+00
```

COLATITUDE = 1.520E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.3420E+00	6.7367E+00						

COLATITUDE = 1.540E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-1.1184E+00	6.6862E+00						

COLATITUDE = 1.560E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-8.9196E-01	6.6038E+00						

COLATITUDE = 1.580E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-6.6681E-01	6.4964E+00						

COLATITUDE = 1.600E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-4.4707E-01	6.3710E+00						

COLATITUDE = 1.620E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-2.3655E-01	6.2346E+00						

COLATITUDE = 1.640E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
-3.8729E-02	6.0936E+00						

COLATITUDE = 1.660E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
1.4322E-01	5.9540E+00						

COLATITUDE = 1.680E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
3.0652E-01	5.8214E+00						

COLATITUDE = 1.700E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
4.4874E-01	5.7007E+00						

COLATITUDE = 1.720E+02 DEG

LONGITUDE (0. DEG)

REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY	REAL	IMAGINARY
5.6785E-01	5.5960E+00						

```
COLATITUDE = 1.740E+02 DEG

     LONGITUDE        (0.        DEG)

                   REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
               6.6219E-01   5.5112E+00

COLATITUDE = 1.760E+02 DEG

     LONGITUDE        (0.        DEG)

                   REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
               7.3048E-01   5.4482E+00

COLATITUDE = 1.780E+02 DEG

     LONGITUDE        (0.        DEG)

                   REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
               7.7182E-01   5.4097E+00

COLATITUDE = 1.800E+02 DEG

     LONGITUDE        (0.        DEG)

                   REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY      REAL       IMAGINARY
               7.8566E-01   5.3968E+00

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